# OUR NATIONAL FORESTS

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Although this report reviews accomplishments of the past year in all major fields of Forest Service activity, special emphasis is given this year to the national forests. Now that the national-forest system has passed its first half-century mark, an accounting of Forest Service stewardship seems in order, and a discussion of policies and programs for the years ahead.

Administration of the national forests is only one phase of Forest Service responsibility. In the interest of national security and welfare, sound management and wise use of forest resources must be promoted and encouraged not only on the public forest lands but on all other forest lands, and the Forest Service is carrying on a number of cooperative programs to this end. It is also conducting a program of research to provide knowledge essential to progress in forestry. Work and accomplishments of the past year in these fields are reviewed, and their relationship to and integration with national-forest administration are discussed in this report.

## NATIONAL FORESTS IN 1948

About a half century ago, our Nation launched a new enterprise in public forestry. It began the administration of a system of national forests that has become a keystone of American conservation and an increasingly important part of the whole national economy. It is today perhaps the best public forest system of any country in the world.

Establishment of the national-forest system marked the first great step forward in the forest-conservation movement in the United States. Most conservation effort previously, and much of it since, found expression only in words—in reports and recommendations, warnings, and exhortations. Much of it has been merely wishful thinking. But the national forests are conservation in practice on the ground. They are going concerns. They still represent the largest tangible accomplishment in forest conservation in this country.

Our national-forest system is a tremendously important public asset which the Forest Service is endeavoring to manage in the best interests of its owners, the people of the United States. The national forests are making many contributions to local and national welfare. They have potentialities for far greater service.

## DEVELOPMENT OF THE NATIONAL-FOREST SYSTEM

In 1891, by act of Congress approved March 3, the President was given power to establish forest reserves within the public domain.

On March 30 of that year, President Benjamin Harrison proclaimed the first reserve (now the Shoshone National Forest in Wyoming). Before his term expired, he set aside forest reservations totaling 13,000,000 acres. Presidents Cleveland, McKinley, and Theodore Roosevelt proclaimed many million acres of additional reserves in the Western States.

Congress, however, had provided no plan of operation for the reserves. They were simply closed areas, their resources locked up. Before that, anyone who wanted timber from the public lands had just gone in and taken it. Many public ranges had been seriously injured by unrestricted grazing. Large areas of public-domain timber were being grabbed by speculators through loose handling of the homestead laws or through outright fraud. Publicly owned resources were being rapidly dissipated.

Locking up the newly established reserves at least put a stop to some of that. But closing the forests was far from popular in the West. Their resources were needed by the growing western communities. Something more than mere preservation of resources was called for; the need was for wise, regulated use.

Then Congress passed the act of June 4, 1897, outlining a broad policy for management of the reserves which made it possible to open them up for managed use. This act, with later amendments, is the one under which the national forests are still being administered.

Until 1905, the General Land Office of the Department of the Interior had charge of the reserves. What forestry know-how then existed in the Government was in the Division of Forestry in the Department of Agriculture. Consequently, the General Land Office sought technical aid from the Division of Forestry—which in 1901 became the Bureau of Forestry. Later the Interior Department recommended transfer of the reserves to the Department of Agriculture.

The transfer was made by act of Congress approved February 1, 1905. The Bureau of Forestry became the Forest Service. The name "forest reserves" was changed to "national forests" in 1907. Under the vigorous leadership of Gifford Pinchot, the first Chief of the Forest Service, development of an effective administration for the national forests went ahead rapidly. Regulations for sale of timber under supervised cutting were put into effect. Livestock grazing was placed under permit. Fire protection was tightened.

Since little public domain remained east of the Great Plains, nearly all the early forest reservations had been made in the Western States. In 1911, Congress enacted the Weeks law, authorizing Federal purchase of forest lands for watershed-protection purposes. The Clarke-McNary law of 1924 broadened the authorization for this purchase program to include lands chiefly valuable for timber production. Under these laws more than 18,000,000 acres of forest land have been acquired for national forests to date, mostly in the eastern half of the United States. Other laws provided for acquisition of land for national forests through exchange or donation. Through purchases, land exchanges, donations, and additions by act of Congress, development of the national-forest system is still going forward.

Today we have 152 national forests located in 36 of the 48 States and in 2 Territories. There are also a number of designated purchase units within which not enough land has yet been acquired for them to

be set up as national forests. Within the boundaries of existing national forests and purchase units are some 229,000,000 acres; the net area of Government-owned lands is about 180,000,000 acres.

These national forests include areas representative of all the country's major forest types, from the great Douglas-fir stands of the Pacific Northwest to the "piney woods" and hardwood bottoms of the deep South; from the pine and spruce of New England to the chaparral of southern California. There are national forests also in Alaska and in Puerto Rico. The national forests contain, in the West, large areas of open forest and wildland range suitable for livestock grazing. They include a substantial portion of the relatively little virgin or old-growth timber still standing. They also include large areas where extensive rehabilitation work is necessary to restore forest growth that had been depleted by fire or destructive cutting, or both.

## Greatest Good of the Greatest Number

The national forests are dedicated to the proposition that conservation is wise use. The policy under which these public forests were to be administered was stated in Secretary of Agriculture James Wilson's letter of February 1, 1905, to the Chief Forester:

> In the administration of the forest reserves it must be clearly borne in mind that all land is to be devoted to its most productive use for the permanent good of the whole people and not for the temporary benefit of individuals or companies. All the resources of forest reserves are for use, and this use must be brought about in a thoroughly prompt and businesslike manner, under such restrictions only as will insure the permanence of these resources * * *. The continued prosperity of the agricultural, lumbering, mining, and livestock interests is directly dependent upon a permanent and accessible supply of water, wood, and forage, as well as upon the present and future use of these resources under businesslike regulations, enforced with promptness, effectiveness, and common sense. In the management of each reserve, local questions will be decided upon local grounds; the dominant industry will be considered first, but with as little restriction of minor industries as may be possible; sudden changes in industrial conditions will be avoided by gradual adjustment after due notice; and where conflicting interests must be reconciled, the question will always be decided from the standpoint of the greatest good of the greatest number in the long run.

These have been the guiding principles of national-forest administration ever since, and they are today.

In line with the primary objective of "the greatest good of the greatest number in the long run" the Forest Service applies two basic principles in the management of national-forest resources. One of these is the principle of "sustained yield." Sustained-yield management of timber means that the forest is managed for maximum continuous production of timber of desirable kinds. The techniques of sustained-yield management vary greatly with different forest types, but the objective is always the same—continuous renewal of timber crops to replace those harvested. The sustained-yield principle applies not only to timber, but to forage grazed by livestock, to wildlife, and to other renewable resources.

The other basic principle is called "multiple use." On a given unit of forest land, some areas may be especially suited for growing timber, some for grazing, some for big-game range. Much of the land may be important watershed. There may be some choice recreation spots; there may be mineral deposits or water-power sites that could be developed; there may be outstanding scenic values that should be safe-

guarded. Under the control of someone interested primarily in just one of those uses, the whole area might be set aside for that one use to the exclusion of all others—perhaps for timber production or for use as a hunting ground. Multiple-use management, however, looks to the coordinated development and use of all the resources and values of the land. Conflicts between various uses are adjusted under over-all management plans. A combination of several uses is usually possible on the same area. Through multiple-use management the Forest Service seeks the highest total of public services and benefits from the national forests.

## National-Forest Resources

### Timber

National-forest timber is for sale. Unless the amount involved is small, timber is sold through public advertisement, to the highest qualified bidder. Small sales may be made at cost, and settlers, farmers, and other bona fide residents in a national-forest community may obtain free timber for their own use where its removal aids in the protection or improvement of the forest.

In every timber sale the purchaser must agree to cut according to specifications prescribed by the Forest Service. Cutting methods required are such as to insure the cut-over areas being left in good condition for future growth. No cutting is permitted that would seriously injure watershed or recreational areas. Scenic and recreation values are the dominant considerations along heavily used roads and highways and in water-front zones.

The Sustained-Yield Unit Act, passed by Congress in 1944, authorized the Forest Service to enter into long-term agreements with willing owners of private timberland for the joint management of both private and public timber under sustained yield. In such a case, a designated tract of national-forest timber and the adjacent or intermingled private timberland will be handled as a unit. Local industry dependent on raw materials from those timberlands will thus be assured of continuous operation. The assurance of a continuous supply of timber permits the industry and the community to plan for permanency and to develop maximum utilization of the available timber resource. This greatly helps to insure both continuity of employment and maximum volume of employment.

The timber output from the national forests has increased rapidly in the past few years. Last year's total cut of over 3¾ billion board feet was almost treble that of 10 years ago.

The yearly cut can be increased still more. Production is not yet up to full sustained-yield capacity on many of the national forests. Substantial areas of mature and overmature timber in the West are still inaccessible and cannot be harvested until access roads are built. In the overmature stands little new growth accrues because growth is largely offset by losses from decay and other natural causes. With proper cutting practices, harvesting the mature and overmature timber will make room for new growth and growth of thrifty younger trees; instead of remaining in a near-stagnant condition, the stand will once more be growing timber.

On other national-forest areas, timber growth is being brought back on lands denuded in the past. But it will be some years before the timber is big enough to cut. And in many places where timber is accessible, mature, and ready to cut, the Forest Service has been unable to prepare timber sales fast enough to meet the demand. Information on the amount of timber that can be cut annually, areas most in need of cutting, and the transportation system required for the most economical harvesting and for continuous management is needed for many national-forest areas. Before a sale can be made, there must be a detailed examination of the area, the supplementary road system to be constructed by the purchaser must be laid out, a determination must be made as to how the timber is to be cut, and an appraisal, contract, and advertisement prepared. Because of limited funds and personnel available for such work, advance preparation of timber sales has not kept up to the desirable level. It would be good business for the United States to advance the funds needed to speed up national-forest timber-sale work. It would help in meeting the Nation's present heavy timber requirements; and each dollar spent for national-forest timber management brings back several dollars to the Treasury.

With more access roads to open up inaccessible stands, and with more personnel to prepare and supervise timber sales, it is estimated that the sustained output of timber from the national forests can be increased more than 50 percent within a few years—from the present cut of under 4,000,000,000 feet a year to at least 6,000,000,000 feet. Eventually even greater timber production can be obtained. Achievement of maximum sustained timber production will require adequate control of fires, insects, and diseases. It will require timber-stand-improvement work to speed growth and improve quality. It will require reforestation of denuded lands. Some 3,200,000 acres in the national forests requires planting to bring the land back to productivity; and there are additional areas so understocked that fill-in planting is needed.

In handling the national-forest timber resources the Forest Service is working toward intensive management for maximum continuous production. Intensive management includes systematic harvesting of mature timber. It includes close utilization to get as much usable wood as possible from the trees cut, and to avoid waste. It includes use of management practices and cutting methods that safeguard immature trees and assure the start of new growth. It includes silvicultural treatment of young stands—such as thinning and "weeding"—to speed the growth of desirable trees. Demand for such materials as posts, poles, and pulpwood is now making possible the accomplishment of some thinning and stand-improvement work through commercial sales. Where this can be done, faster and better timber growth is obtained, and the work pays for itself besides. But stand-improvement work on many forest areas would be a good investment for the future in any event.

Large structural timbers, highest quality lumber, some kinds of veneers and plywoods, and certain other specialty products can be made only from large sound trees. As the old-growth forests are used up, high-quality timber for these special products will become

scarcer. It takes a long time to grow high-quality timber, and the national forests can do a special service in assuming a substantial part of the country's future production of big timber and high-quality material.

Not all national-forest land is capable of producing commercial timber. More than half is of noncommercial forest types, such as alpine, semiarid, or chaparral. These noncommercial forest lands usually are extremely important watershed lands. Many are also valuable for grazing, wildlife, or recreation; and they may supply some low-grade products, such as fence posts and fuel, perhaps, but they are not a source of lumber, pulpwood, or other major timber products.

Of the 461,000,000 acres in all ownerships classed as commercial forest land in the United States, 73,000,000 acres, or about 16 percent, is in the national forests. But the national forests now contain more than 30 percent of the Nation's total volume of standing saw timber. The national-forest timber is becoming more and more important in meeting the country's needs for forest products. Many sawmills that formerly had supplies of private timber are now wholly dependent on national-forest timber to keep going.

With only 16 percent of the country's commercial timberland, the national forests cannot by any means supply all of the Nation's requirements for wood. We must look to forest lands in all ownerships, and mainly to those in private ownerships, to meet our needs.

But the national forests will be a big help in carrying us through until the country's total saw-timber growth can be built up. And they will be just as important permanently as in this interim (which may be a long time). Managed for sustained yield, the national-forest timberlands will be a never-ending source of timber, a permanent support for many local industries and the communities dependent upon those industries, and a backlog of security in the Nation's future.

## Forage

In the national forests of the Western States there are many mountain meadows, stringers and pockets of grassland in the timber, open woodlands where grass or browse plants grow between the scattered trees, and other areas that are used for the grazing of livestock. In the Soueast many "piney woods" areas in the national forests can be grazed.

All told, some 80,000,000 acres of national-forest lands are suitable for grazing. Most of these national-forest grazing lands are in the West. They are only a small part of the 728,000,000 acres of western range, but they play a highly important part in the western livestock economy. Generally at the higher elevations, the national-forest ranges provide green forage during the summer months, when other suitable range is limited. They thus help to carry livestock herds through the summer season and produce grass-fat stock for the fall markets. In the Southwest, some national-forest ranges can be grazed year long.

Adjoining or surrounding many of the western national forests are public-domain lands that are administered as grazing districts by the Bureau of Land Management of the Department of the Interior.

The national-forest ranges, the grazing districts, and the private ranches in the vicinity all supplement each other, and are interrelated parts of the western livestock picture. A typical rancher may run his cattle or sheep under permit on national-forest range during the summer months and carry them through the winter on grazing-district land or on pasture or feed lot on his own ranch.

When the Forest Service was assigned responsibility for administration of the national forests one of the toughest problems it took on was the grazing use. Previously grazing had been unrestricted; there had been constant conflict between users of the range; too many arguments over range had been settled by the six-shooter; far too many livestock were running in the forests; and many of the ranges were already badly overgrazed. The Forest Service undertook to bring order out of this chaos, to set up an equitable system of allotment of grazing privileges, and to bring grazing use into balance with sustained forage growth.

National-forest grazing policies are clearly defined. The home builder is given preference in grazing privileges over the itinerant stockman or speculator. Stability of livestock operations is promoted through long-term permits and renewal preferences to established permittees. "Economic units" are encouraged—livestock operations large enough so that the rancher can make a good living but not so large as to create monopoly. Grazing fees are adjusted yearly in relation to livestock market prices, according to a formula worked out in cooperation with the livestockmen's associations. Where substantial adjustments in permitted numbers of stock must be made, they are made gradually to avoid sudden or drastic upsets in the permittee's operations.

The demand for grazing privileges greatly exceeds the amount of national-forest range available. The Forest Service is under constant pressure to let in more stock, and it is under pressure from stockmen who now have grazing privileges to convert those privileges into vested rights. But, in spite of all these pressures, there is a conservation job to be done—to build up and maintain the national-forest ranges as a permanent resource.

At least half of all the national-forest rangeland allotments are now in good condition. On the remainder further improvement or adjustment is needed. Some of the ranges are still overstocked. On these the Forest Service program of adjustments has not moved fast enough to prevent progressive deterioration of the range. This may have been because the grazing capacity of the range was overestimated, or because the Forest Service leaned over backward to avoid causing hardship to permittees dependent upon those ranges. But, in any event, where serious problems of range deterioration exist, decisive action must be taken to save the range.

When a cow has to walk several yards from one bite of grass to the next it does not put on weight very fast. On some overgrazed ranges it now takes 50 to 100 acres or more to support one cow through a grazing season. If such ranges can be brought back so that 2 cows—or 5 or 10 cows—can graze where 1 cow grazed before, the livestock industry will benefit, and so will people who would like to eat meat.

Nevertheless, some stockmen, understandably enough, are loath to accept any reductions in numbers of livestock on the forest ranges,

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even though the reductions are made for the benefit of their allotted range.

Most western national-forest ranges are important watershed lands. Other people of the West, therefore, also have a vital stake in these lands—in seeing that the watershed values are protected, that erosion and siltation of reservoirs are prevented, that water is conserved, and flood danger kept to a minimum. Range conditions may affect irrigation farming, water tables, power developments, stream flow, and town and city water supplies over large areas in the Western States.

Many national-forest ranges also have recreation values and wildlife values. Sportsmen and recreationists therefore have an interest in these lands. In the management of these ranges the Forest Service must consider all these interests—the immediate and long-term interests of the livestock industry, the sportsmen and recreationists, the water users, the welfare of local communities, and the whole economy of the western regions. On all counts the situation calls for keeping the ranges permanently productive where they are already in good condition and for restoring forage growth and good watershed conditions where deterioration is under way.

Forest Service research has developed methods for successfully reseeding certain types of damaged ranges in several of the western regions. Reseeding of depleted ranges and getting them restored to productivity in some cases has increased the grazing capacity as much as 10 times. The Forest Service is carrying on reseeding operations on worn-out range as rapidly as funds become available. On many deteriorating ranges a rest period from grazing or a reduction in stocking may allow forage growth to come back naturally. In other cases more fences or development of watering places for stock, to obtain better control and distribution of the stock on the range, may be all that is needed to bring grazing in balance with forage growth.

In colonial days many New England villages set aside a community pasture or "common" where local people could graze their livestock. Range areas in the national forests of the West are in a sense public grazing commons for the western communities. As the manager in charge, the Forest Service is endeavoring to handle the distribution of grazing privileges on these areas fairly and equitably, and administer the forest ranges in the best long-term interests both of the grazing users and of the whole public. Where the desires of a single user conflict with the public interest, the public interest of course must come first.

In the national forests of the Southeast, grazing use thus far has been a less complex problem. It involves mainly the coordination of grazing use with timber growing, and the development of techniques for obtaining best use of forage values.

In the multiple-use management of the national forests grazing has an important place. The national-forest forage resource can contribute materially to the Nation's production of meat, wool, and leather. This forage crop should be utilized; and it should be sustained. The Forest Service objective is to develop the range resources of the national forests for maximum permanent production and use in the interest of a stable, prosperous livestock industry, with full protection of watershed values and other values and services in the public interest.

## Wildlife

Our national forests are the home of well over 2,000,000 head of deer, elk, and other big-game animals—about one-third of the Nation's total big-game population. In the Western States about 70 percent of all big game lives part or all of the year in the national forests. These public forests furnish the habitat for countless thousands of small-game animals, upland birds, and fur bearers. Much of the Nation's best trout waters (90,000 miles of unposted streams and 1½ million acres of fish-producing lakes) are found in the national forests. In the aggregate, our national-forest system constitutes one of the largest areas of public hunting and fishing ground in the United States.

All this represents a wildlife resource not only of recreational value and scientific value, but of great economic importance as well. Last year the national forests were host to more than 4½ million hunters and fishermen, who spent a total of more than 16½ million man-days in the field. Their catch was a not inconsiderable contribution to the Nation's food larder. On the average, for each day in the field, each sportsman spent several dollars for equipment, food, gasoline, and other expenses—money which helped support industries and many local small business enterprises and thus helped to provide employment and income for many people. The income to a number of States from sale of fish and game licenses is largely based on the hunting and fishing opportunities provided by the national forests.

Management of the wildlife as a permanent resource in the interest of good hunting, good fishing, and other forms of enjoyment and use is part of the multiple-use program of national-forest administration. The Forest Service aim is to produce the maximum amount of wildlife consistent with the needs for other essential resources and the requirements of watershed protection.

It is Forest Service policy to cooperate with the States on matters pertaining to wildlife on the national forests. The State fish and game or conservation departments assume responsibility for protection and utilization of the resource and may also conduct research on forest wildlife. State regulations as to licenses, seasons, and bag limits apply on national-forest lands, except on Federal refuges or similar designated areas. In many of the forests State authorities and the Forest Service are cooperating in special wildlife-management projects.

The Fish and Wildlife Service of the Department of the Interior takes Federal leadership in fundamental research to determine the principles upon which wildlife management plans may be based. That agency also may act in an advisory capacity to the Forest Service in the carrying out of such plans and principles.

The Forest Service works with the States on management and utilization activities. Many national-forest rangers are deputized as State wardens and aid in the enforcement of State game laws on national-forest lands. Forest officers keep track of trends in wildlife populations, make habitat surveys, and advise with the State authorities as to proper seasons and bag limits. Forest Service research in forest and range management often has a direct bearing on wildlife-management practices. The main function of the Forest Service, however, is to provide and maintain a favorable habitat upon which wildlife can be produced.

Thus the Forest Service, the Fish and Wildlife Service, and the State fish and game departments all have distinct and important roles to play. Through carefully arranged and coordinated cooperative procedures their programs are made complementary to each other, with little or no overlap or duplication.

In creating and maintaining a healthy wildlife habitat, the Forest Service must develop ways and means for integration of wildlife use with other normal forest uses so that the forests and ranges are kept in a productive condition. Plans are necessary, for instance, to insure that wildlife food and cover are not destroyed during timber-stand improvement or logging operations on the one hand or that excessive game populations do not destroy important timber values on the other. In general, orderly, sustained-yield logging of timber fits in well with wildlife management. It provides a large aggregate amount of open spaces and forest "edge" where the choice game food plants grow. Dense, unbroken timber stands support relatively little game.

On livestock ranges use of forage by domestic animals must be balanced with use by game. There is less conflict between the two than might be expected, however; and where conflicts do occur it is usually a case of overstocking, either with livestock or big game, or both, in relation to natural food supply.

The Forest Service also can carry out certain practices aimed directly at habitat improvement and maintenance. It can improve food and cover conditions by such means as selective thinning of timber, creation of openings in dense stands, planting of food trees and shrubs, and development of watering places. For maintenance of sport fishing it must frequently improve streams and lakes and stabilize banks and shores.

The Forest Service recognizes the interests of the scientist, the camera hunter, and the nature lover as well as those of the sportsmen in national-forest wildlife. Hunting may be restricted in picnicking and other special recreation areas. There is provision for setting aside certain areas to safeguard rare or vanishing species. A special area has been set aside in California, for instance, to protect the nesting sites of the near-extinct California condor, largest of the North American birds.

When the Forest Service began administration of the national forests, game populations in most places had been seriously reduced. Many States had no modern game laws, and there was little control of poaching in many of those that did. The Forest Service encouraged the establishment of nonpolitical game commissions in the States and the enactment of sound game laws. In cooperation with the States many transplants of deer, elk, beaver, and other species were made to restock depleted areas. Since 1921, when the first country-wide national-forest estimate of game population was made, big-game numbers have nearly quadrupled. The greatest increases have been in deer and elk. Moose, bear, and mountain goat have shown more moderate increases. Only bighorn sheep, among the principal big-game species, have declined, but these now seem to be holding their own.

Until recently the national-forest deer population was doubling itself every 10 years. During the past few years, however, it has become apparent that the era of big annual increases is about over. Many of the big-game ranges are now fully stocked or in some instances overstocked, and a leveling off in numbers is to be expected. Problems

of overpopulation have arisen in some areas, although there are still opportunities elsewhere for increases in game.

Where overpopulation exists, Nature might eventually correct it. But Nature would do it in a cruel way, and wastefully. The deer or elk would eat up their natural food supply, and then the herds would be decimated by starvation and disease. The range would be so depleted that it could support little game for years to come. The Forest Service believes that a better way to solve problems of overpopulation is to bring game numbers into balance with their range by carefully regulated hunting. In cooperation with the States the Forest Service is improving conditions on a number of areas of overconcentration. But on the overstocked areas where herds have not yet been reduced, as well as on many areas where reductions have recently been made, there is still much deteriorated range that is in urgent need of rehabilitation.

The Forest Service is faced with an increasing demand for hunting on the national forests. This use has increased to unprecedented totals since the war, and indications are that it will continue to increase for some time. The Forest Service must determine the legitimate demands for game in relation to other resources, and the grazing capacity available to it, and then work closely with the States in seeing that carrying capacity and game numbers are kept in proper balance.

During the war, when efforts had to be concentrated on other activities, the Forest Service discontinued practically all wildlife operational projects. A big backlog of needed work and of critical maintenance of prewar developments piled up. No funds have been appropriated directly for wildlife work during the past 2 years, and the backlog is still growing.

The Forest Service, however, will continue its efforts for full development and maintenance of the wildlife resource, in relation to other resources, on the national forests, for its scientific and recreational values, for good hunting and fishing, and as a continuing contribution to the economic support of local communities.

## Recreation

All national-forest lands are open for recreation. A visitor may go anywhere and stay as long as he wishes. The only exceptions are certain small areas within the forests that may be restricted for special purposes, or areas of high fire hazard that may be closed to entry during periods of fire danger. In some heavily used areas a camper's stay at any one camp ground may be limited to a week or two so as to give others a chance.

Within the national forests are many scenic attractions and places of other special interest which attract the tourist-sightseer type of visitor. The bulk of the recreational use, however, is by those who come to the national forests for recreation in the truest sense—for rest and play, for the enjoyment of outings in the forest environment.

Many facilities have been provided for this recreational use. The Forest Service has developed 4,500 camping and picnicking areas, where tables and benches, fireplaces, safe water supplies, toilets, and garbage-disposal facilities are available. Trailer parking sites are available in many places. Hundreds of swimming holes and beaches have been improved.

The 230 winter-sports areas that have been developed on the national forests include many of the most popular areas in the country. The higher western ranges provide the terrain, snow conditions, and climate which are helping to make skiing a national sport of major importance. The Forest Service develops the public-use areas and some public shelters, and permits private capital to install ski lifts, ski tows, restaurants, and lodges.

There are 400 organization camps, provided with dormitories or cabins, mess halls, and other facilities for group outings. Some of these are maintained by the Forest Service and made available to civic and welfare organizations sponsoring low-cost vacations for underprivileged children; others are maintained under free permit from the Forest Service by municipal welfare agencies, Boy Scouts, Girl Scouts, and other civic groups.

More than 50,000 miles of national-forest highways and secondary roads are available to the motorist. Thousands of miles of hiking and horseback trails are sign-posted and maintained.

Numerous commercial resorts and cabin camps operate under special-use permit from the Forest Service. Permits also are issued for the use of sites on national-forest land for operation of stores, restaurants, service stations, ski lifts, horse-rental and boat-rental establishments, and other commercial facilities serving the vacationing public. A number of dude ranches operate within or near national forests and feature trips in the forests for their guests. In some of the national forests individuals may lease sites where they can put up their own summer cabins.

The Forest Service manages the recreation resource of the national forests with the least possible restriction of public use consistent with the safety of the public and the protection of the forest. It endeavors to provide abundant recreation opportunities for all—for those with slim pocketbooks as well as those with fat pocketbooks. Public recreation facilities have first priority. Private uses, such as summer-cabin sites for individuals, are permitted only on areas where there is no foreseeable need for public use. Modifications of the national-forest environment are kept to a minimum, and necessary developments and facilities are designed to be in keeping with the forest environment.

To preserve for all time representative examples of the American wilderness, the Forest Service has set aside 77 wilderness areas, wild areas, and roadless areas within the national forests. These areas total some 14,000,000 acres—an area larger than New Hampshire and Vermont combined. They are maintained in substantially primitive, unmodified condition. Commercial timber cutting is not permitted, but since most of the areas are in high country with low commercial timber values, setting them aside has not actually withdrawn any great amount of usable timber from harvesting. Some regulated grazing by livestock may be allowed. The areas will be kept roadless, accessible only by trail or water. Many of them are the home of fine big-game herds. Among the last remnants of the wilderness in America, they will continue to provide opportunities for the enjoyment of wilderness recreation—for those who yearn for solitude or who want really to "rough it."

The Forest Service believes that access to the national forests for recreation should remain, as it is now, free to the public. But there is

some question as to whether some of the special services and facilities now provided should continue to be furnished without charge. It costs the Government—i. e., the taxpayers—quite a bit to provide some of these services. For example, at some heavily used swimming places, the public safety requires that a lifeguard be on duty. Part-time or full-time custodians must be kept at many of the camp and picnic areas to maintain facilities, check vandalism, dispose of garbage, etc. Moderate charges for the use of some of these special facilities and services could help to offset their costs. The Forest Service is exploring this question—whether recreational use in the national forests should pay at least some part of its own way.

Recreational use of the national forests is steadily increasing. The number of recreational visits in 1947 reached a new high, 21,000,000. Average length of stay per visit was 1.6 days. Because the same person may be counted more than once if he visits other forests or makes a repeat visit to the same forest during the season, the Forest Service reckons recreational use in terms of "visits" rather than visitors. The 21,000,000 visits by recreationists did not include some 56,000,000 additional visits made by motorists out to enjoy the forest environment or sightseers passing through.

The major portion of the recreational use is confined to less than 1 percent of the national-forest area. Improved camp and picnic areas, winter-sports areas, organization camps, summer homes, and resorts occupy only 146,000 acres, but these areas received 13,000,000 out of last year's total of 21,000,000 recreational visits. That means an average of 89 visits per acre, or 142 days' use per acre per year—certainly a heavy use of the land. The other 8,000,000 visits were to other forest areas, by hunters and fishermen, wilderness travelers, etc.

This heavy public use is overtaxing many existing national-forest recreation facilities and making the job of clean-up and maintenance very difficult. Many popular areas are regularly overcrowded during the vacation season. Overcrowding reduces the enjoyment of those using the area. It may also spoil the area for future recreational use. Attractive ground cover is destroyed, dust accumulates, even mature trees are weakened and killed.

The appropriations available for recreation work have been insufficient to do more than maintain essential sanitation and fire-protection facilities and keep the recreation areas usable. Since the war there have been virtually no funds available for development of additional public recreation facilities to relieve the overcrowded conditions on existing areas. Most of the present recreation developments in the national forests were constructed during the 1930's with Civilian Conservation Corps labor and funds. Then came the war and maintenance and development work was largely suspended. Many facilities have deteriorated beyond repair, and it is becoming increasingly difficult, as the facilities get older, to keep essential things in good, safe operating condition.

Recreational use, like the use of other national-forest resources, has economic values of considerable importance to the local communities. For many towns and cities in the vicinity of the forests, the tourist and vacation business is a major source of income. The long-term program of the Forest Service calls for building up and main-

taining the national forest recreation resource, so as to contribute permanently to the welfare of local communities and provide abundant opportunity for healthful outdoor recreation for the people of the United States.

## Water

Watershed protection is a basic consideration in all national-forest management programs. To secure "favorable conditions of water flows" was one of the stated purposes in the 1897 Act, which provided for administration of the forest reservations. Public concern about floods was largely what led to enactment of the Weeks Law of 1911, authorizing Federal purchase of watershed lands.

In the West, national forests are at the headwaters of most of the major rivers and streams. National-forest lands are the source of water supply for hundreds of towns and cities, for many of the industrial plants, power projects, and irrigation farm developments on which the economy of the Western States largely depends. East of the Great Plains, where national forests are fewer and farther between, they do not bulk so large in the total water-supply picture. But the national forests of the Ozarks, the Appalachians, and other important watershed areas are of vital significance in local and regional water-supply and flood-control considerations.

Our Nation's water supply is a problem of growing concern. Instances of depleted or reduced ground waters are increasing across the land. Diminished water yields are becoming more apparent each year in a number of areas. Lowered water tables are developing from the Pacific Northwest to southern California, throughout the entire Southwest, in the Plains areas, and eastward into the Allegheny and Blue Ridge flood plains. Salt-water intrusions occur intermittently along the Atlantic, Pacific, and Gulf coastal regions. Further agricultural, industrial, recreational, and municipal developments are at an impasse in many areas unless additional water can be obtained. At the same time vast amounts of water are wasted and terrific damage is done each year by floods. The management of our watersheds for reduction of flood danger and for maximum production of usable water is of the utmost importance.

Our watershed problem involves many farm lands and vast wildland areas both in public and private ownership. Through its efforts to promote good forest and range management generally, and in various cooperative programs with other Federal and State agencies, the Forest Service is endeavoring to help bring about improved conditions on watershed lands in all ownerships. Furthermore, it has direct responsibility for watershed management on some 180 million acres of national-forest land.

Watershed protection therefore must be tied in with all timber management, grazing management, recreation, road construction, and other activities on the national forests. In some localities, it is the paramount consideration. Where critical watershed values are involved, other uses must be restricted to the extent necessary to protect those watershed values. Usually, however, regulated timber harvesting and grazing use can be carried on without serious impairment of watersheds. Research is developing techniques by which timber cutting can be better coordinated with watershed protection; in some cases it can actually be made to improve watershed conditions.

Fire control is extremely important. With increasing realization of the importance of watershed cover and with growing needs for national-forest water, it has become apparent that standards for intensity of protection must be raised in many areas. It may be even more important to protect the "worthless" brush on an area of high watershed value than a stand of choice timber on an area of low watershed influence.

As a result of fires, overgrazing, or other causes, there are still too many watershed sore spots in the national forests. On these critical areas special improvement work is needed—such work as contour trenching, road stabilization, stream-channel and bank stabilization, construction of small dams to check erosion gullies, reforestation, or revegetation.

As rapidly as it can with present funds available the Forest Service is making intensive watershed studies on individual national forests. These studies determine actual and potential water yields, soil conditions, cover conditions, present and prospective water requirements of the tributary communities, and other factors. The studies will provide a sound basis for long-term watershed-management plans aimed at building up and maintaining good watershed conditions and conserving national-forest water resources of fundamental importance to local and national welfare.

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These, then, are the major resources of our national forests—timber, forage, wildlife, recreation, and water. There are others. Mineral deposits exist in many of the forests, and, except for certain reserved areas, national-forest lands are open to prospecting and location of mining claims. A variety of other products are available, such as gum naval stores, fern hay, peat moss, and Christmas greens.

The major resources are renewable resources. Under sustained-yield management they can be produced in perpetuity. Under the multiple-use system of administration, their uses will be coordinated and balanced one with another, for the greatest total of returns.

## COSTS AND RETURNS

It is always pertinent to ask about the costs. What are the costs of national-forest administration in relation to returns?

For operation, management, and protection of the national forests last year the Forest Service spent approximately $32,000,000. In addition, approximately $13,000,000 was spent from appropriations by Congress for roads and trails and for purchase of land. Part of these expenditures can be classed as capital investments.

The yearly operating costs are not large in comparison with many governmental activities and many private industrial enterprises. They represent less than one-tenth of 1 cent of the tax dollar. Furthermore, they are offset in large part by national-forest receipts, which last year totaled nearly $25,000,000.

Nevertheless, the Forest Service aims at getting a dollar's value for every dollar spent. It is proud of its reputation for efficiency; and it is constantly working to attain even greater efficiency, through management studies and controls, decentralization and delegation of authority, and in-service training of personnel. Job-load-analysis

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studies conducted by the Forest Service have received favorable attention from industrial-management experts and other Government agencies.

Many of the national forests more than pay their own way—that is, cash income exceeds operating costs. On others, especially those containing large areas of cut-over and burned-over land recently acquired, receipts may be expected to increase as new timber growth is built up. A substantial amount of national-forest land, however, will probably never produce much cash revenue. Areas above timber line and such noncommercial forest lands, for example, as the chaparral forests of southern California are largely of non-revenue-producing character. The costs of protecting some of these areas are nevertheless very high, but vital watershed and other values make protection a necessity, and the benefits exceed the costs many times.

Timber sales, grazing fees, and special uses account for most of the cash receipts. National-forest receipts go to the United States Treasury; they cannot under existing law be applied toward meeting operating costs. With only minor exceptions, all funds for national-forest administration and development must be appropriated by Congress, and the funds appropriated are specified for particular uses.

Each year, however, an amount equal to 25 percent of the receipts goes to the counties containing national-forest lands. The counties' share of national-forest receipts is used for local roads and schools. An additional 10 percent of receipts is allotted for expenditures on national-forest roads in the States of origin, so that the States and counties get the direct benefit of 35 percent of national-forest gross receipts.

Although national-forest income has steadily increased and may be expected to increase still more, it may not equal the costs of administration and annual capital investments. Many of the national-forest activities are nonrevenue producing. Most recreation facilities are provided for the public free of charge. Roads and trails are constructed and maintained for the benefit of the public. Wildlife-management work brings in no direct returns, although the cash spending of more than 4,000,000 hunters and fishermen who utilize the national forests each year means an important source of income to local business, and the income to many of the States from sale of fish and game licenses is based largely on the hunting and fishing opportunities provided by the national forests. Watershed-management work likewise produces no revenue, but the value to local communities and the Nation in terms of flood control and safeguarding of water supplies is inestimable.

It would be difficult to value such services in monetary terms. The objective of the national-forest enterprise, however, is not profit but public service. Undoubtedly the returns in public benefits each year are far greater than the costs.

## DEVELOPMENT FOR MAXIMUM PUBLIC SERVICE

With full development, the benefits of the national forests to the people of the United States can be greatly increased. What is needed for development of the national-forest system for maximum public service?

## A Stepped-Up Program of Management and Improvement

Some major needs already have been indicated. They include more intensive timber management, measures to build up ranges, more intensive wildlife management, more recreation developments, and intensified watershed management.

Timber-management needs include more access roads, more timber-stand improvement work, more planting, more intensive control work on forest insects and diseases, and more personnel for preparing and supervising timber sales.

Building fences, developing water supplies, improving stock driveways, controlling destructive rodents, and getting rid of poisonous plants are activities that will help to restore and develop forest-range resources. Reseeding has immense possibilities for large-scale restoration and improvement of forage yields.

There is need for a great deal of wildlife-habitat-improvement work, especially on areas damaged by too heavy concentrations of big game. In fishing waters, stream-improvement work, such as protection of spawning places and building small dams to create trout pools, can provide better fishing.

There is need for more ski trails, swimming places, camping and picnic grounds and safe water supplies for them, and for more administrative and custodial personnel to handle the steadily increasing use of national-forest recreation facilities.

Watershed-improvement work is needed on critical water-source areas; and intensive surveys are still needed for many watershed areas as a preliminary to the actual protection work.

To back up such resource management and development work, many improvements and facilities for general administration and protection are needed: Replacement of unsafe lookout towers; improvement of telephone and radio communication systems; surveying and mapping; more and better housing for national-forest personnel. Roads are needed not only for access to timber stands but for fire protection, recreational use, and proper management of the forests. Many national-forest roads are important links of main transcontinental highways or of the State highway systems. The planned road and trail system for the national forests includes some 37,000 miles of roads and 21,000 miles of trails as yet unconstructed, in addition to 103,000 miles of roads and trails now of unsatisfactory standard.

Most of these things mean more money and more manpower. Forest-protection work, however, such as expansion of fire-control facilities, insect control, and the like, is insurance against loss of existing values; and insurance against possible loss is generally considered good business. Forest-improvement work—tree planting, timber-stand and range improvement, development of recreation facilities, etc.—is a capital investment that will pay future dividends either in increased yield of products or in other services and benefits.

The Forest Service is confident that it can continue to make expenditures for national-forest improvement and development yield handsome returns in community benefits and contributions to the economic welfare of the Nation.

## Stability for Public Ownership

Some 155 million acres of national-forest land is public domain which was reserved for national-forest purposes by Presidential proclamation under the Act of March 3, 1891. The status of these public conservation lands is not as secure as it might be. Certain types of use, legitimate and desirable as such, may be authorized on national forest lands without the consent of the agency in charge of those lands. Large areas of national forest land may be flooded under the Reclamation Act with no provision for giving the Secretary of Agriculture any voice as to whether even greater public values may be destroyed. The Mineral Leasing Act of 1920 gives the Secretary of the Interior the right to lease national forest lands for exploitation of certain minerals, including oil and gas, also without consent of the Secretary of Agriculture.

No one will wish to prevent the utilization of mineral, reclamation, or hydroelectric power values needed by the United States. Under the Forest Service policy of the greatest good to the greatest number in the long run, the utilization of valuable mineral resources and the impounding of water for reclamation or power will always rank high among uses of national-forest land. But there should be provision for development in such a way that these necessary resources can be obtained without needless damage to watersheds, timber, recreation, or other values.

The General Mining Laws give any individual the right to locate, enter, and patent national-forest land in most places upon discovery of mineral values (except for the eight minerals covered by the Mineral Leasing Act) sufficient to justify development of the claim. The law makes no requirement that mining be done on the land after patent, and it provides no checks on damage to soil, timber, water, or other values. If, after patent, it becomes evident that the minerals are not commercially valuable, the patentee may still retain title to both surface land and subsurface. The law is vulnerable to abuses deplored alike by public land administrators and bona fide miners; and the case histories of many mining claims show that mineral development has not been the end result. There are also examples of mining activities which are decidedly contrary to the public interest. In many instances the cost to the public far exceeds the gain to the mining operator.

The search for oil and gas and other minerals is being intensified by shortages. As the more valuable deposits are depleted, less accessible and poorer quality deposits will become commercially valuable. Exploitation of deposits of oil shale and low-grade coal, which underlie large areas of national-forest land, may develop before many years.

All these things mean an insecure basis for sustained-yield forest management, and for maintenance of public resources and properties in which millions of dollars have been invested and for protection and development of which millions are being spent each year.

The over-all public interest should be the criterion in the disposal of public resources. There are lands of the United States on which mineral utilization is unquestionably the best use of the land; there are other areas having mineral values on which other values are undoubtedly higher. The decision as to whether or not a certain area is more important as a reservoir site for irrigation or power, as a mining

site, or as public timber, grazing, or recreation land cannot be decided by evaluating only one resource. It requires a comparison of all present and future public values to determine which use yields the greatest net public return in the long run.

Often reasonable restrictions will make possible utilization of a resource without impairment of other values. Location of an unrestricted mining claim, for instance, on the watershed source of a large city's water supply might be disastrous, because the claimant would not be bound to consider the requirements of the city. But the utilization of mineral values under permit, suitably controlled to protect the city's water, might be possible without seriously reducing the profit of the enterprise.

On those national-forest lands acquired by purchase under the Weeks law, as differentiated from those withdrawn from the public domain, the status of public ownership is a bit better. Weeks-law lands also may be leased by the Secretary of the Interior for exploitation of minerals, but the consent of the Secretary of Agriculture is required. The Secretary of Agriculture also is given the right by law to attach such conditions to his consent as may be necessary to safeguard national-forest land values for the primary purposes for which they were acquired and are being administered. The lessee's operations are controlled and he pays a just price for the privilege of exploiting a public resource. The extensive operations of several major oil companies under these provisions prove that unrestricted title to the land surface is not essential to successful mineral operations. The safeguards that protect the public interest in regard to mineral leases on national-forest lands acquired under the Weeks law might well be applied to the national-forest lands reserved from the public domain. Similar provisions would be appropriate in the case of other uses not now subject to approval of the Secretary of Agriculture.

The whole national-forest resource program should be superior to exploitation of any single resource, and the decision as to whether any single use is of sufficient national importance to justify interference with the over-all national-forest objectives should rest with those responsible by law for carrying out those objectives.

## Consolidation and Extension

Within the established boundaries of most national forests are numerous tracts of privately owned land. Indeed, in several of the western national forests the pattern of ownership is like a checkerboard, because each alternate square mile passed out of public ownership as a result of early land grants to the railroads. In national forests established through purchase of lands under the Weeks law, Federal ownership is often spotty because the land-purchase program is far from completed.

Such spotty or checkerboard ownership causes many problems in national-forest administration and protection. The uses to which intermingled private lands are put often interfere with or nullify sustained-yield timber management, watershed protection, or other national-forest objectives. It costs a great deal of time, effort, and money for establishment of rights-of-way for the movement of

national-forest resources and the development of roads, trails, telephone lines, and other requisites of effective forest management.

The exterior boundaries of existing national forests and purchase units include, all told, some 49,000,000 acres that are in other than Federal ownership. Of such lands, approximately 14,000,000 acres appear to be more suitable for other purposes than public forest and are likely to remain in private ownership. The remaining 35,000,000 acres are generally of the same types and have the same potential uses as the national-forest lands. For effective development of the national forests, these intermingled lands should be acquired and managed as integral parts of the forests.

There are also some areas of land adjoining the present boundaries of national forests that should be included in the public forests. These marginal-fringe lands, most of which are now cut over, are logical parts of national-forest watershed or timber-management units; and their present exclusion from the national forests adversely affects the protection, management, and development of the national forests in much the same way as the spotty character of public ownership within the forest boundaries.

Land may be acquired for national-forest purposes through exchange of national-forest land or timber for privately owned land, through donation, or through purchase. Land exchanges are effecting many desirable adjustments of ownership between the public and the owners of private property within forest boundaries, to the advantage of both. A number of donations of land from public-spirited citizens are received each year, but though the donated tracts may be of special value for administrative sites or other purposes, they do not usually add up to much acreage. An adequate attack on the problem of needed consolidation of public ownership within the boundaries of the national forests and purchase units will have to be through Federal purchase of lands.

Appropriations for land purchase last year were enough to buy about 103,000 acres. The Forest Service believes that a greatly stepped-up purchase program would be in the public interest. It would make for more effective and economical management of the national forests and speed their consolidation and development so that they could more fully perform the functions for which they were established. It would be advantageous, too, if the appropriations for land purchases were made available at a more or less uniform yearly rate and could remain available until expended. Negotiations for purchase of lands could then be carried on in a more orderly, systematic way, rather than on a when, as, and if basis. A trained, experienced staff could be maintained to handle the purchase work efficiently and economically, instead of hurriedly building up a big staff for a large purchase program one year and disbanding it another.

State and county governments are sometimes reluctant to see lands purchased for national-forest purposes taken off the local tax rolls, even though much of the land that might be acquired now pays little or nothing in the way of taxes. Lands in national forests created from the public domain never were subject to tax. Nevertheless, the Forest Service feels that national-forest lands should contribute a fair share toward the maintenance of local governments. The 25 percent of yearly forest receipts that under present law goes to local county

road and school funds is apt to fluctuate considerably from year to year, and different national forests vary widely in amount of receipts. It is apt to be least when the need of the counties is greatest. Denuded lands acquired for national-forest purposes bring in few receipts during the period of restoration. Some method that would put the Federal financial contribution to local governments on a more stable and equitable basis would be desirable. It would help promote stability for local governments, and it would facilitate the purchase program for consolidation and development of the national forests.

Legislation enacted by Congress in 1948 provided for an annual Federal payment to the counties of three-quarters of 1 percent of the appraised valuation of the national-forest land within a specified area of the Superior National Forest in Minnesota. This system of annual payments based on a fair percentage of true value of national-forest property, instead of the 25 percent of receipts procedure, might well be applied nationally.

It is probable that our national security and welfare will eventually require a considerable expansion of public forest ownership. There are certain lands where acute problems of watershed protection or other vital public interests make public acquisition and management a virtual necessity. There are also some forest lands where the productivity is too low for private owners to be expected to hold them for timber growing. There are forest lands so denuded as to offer no prospect of income for many decades, and with little prospect of rehabilitation by private enterprise. And there are tracts of timberland now subject to destructive exploitation the liquidation of which would vitally affect the welfare of dependent communities. Measures necessary to maintain or restore the economic values of many such lands are not now in prospect or reasonably assured; and if these lands are to do their part in meeting the Nation's resource needs, instead of being carried as dead weight, public ownership may be the only answer. The importance of public ownership is increasing with the Nation's delay in adopting adequate forest-conservation measures.

Some of the forest lands acquired for public ownership may be better suited for management as State or community forests than as national forests. Where forest lands acquired for public ownership are in large tracts, include watershed areas of interstate importance, or involve large-scale jobs of restoration, development as national forests is generally indicated. Smaller, scattered tracts might be made State forests, or county and municipal forests. National, State, and community forests complement each other; all these categories of public forest ownership have a part to play in our national economy.

## THE NATIONAL FORESTS' PLACE IN THE TOTAL RESOURCE PICTURE

In the development of our national-forest system the going has not always been easy. Some mistakes have been made. But the Forest Service feels it has reason to be proud of accomplishments to date. It is certain that with full support and cooperation of the American people the national forests can be developed for even greater public service.

What is the place of our national-forest system in the Nation-wide resource picture? How does it fit into our national economy?

At the foundation of our economy are the natural resources. Upon the soil, water, wood, grass, minerals, and other basic resources, all agriculture, industry, and trade depend. Only as those resources are maintained and wisely used will our Nation progress and prosper. Resources that are nonrenewable must be carefully husbanded; those that are renewable must be continuously renewed.

Under the law of the jungle, each individual seeks to obtain and control resources for his own exclusive use, to get as much as he can before another gets it. Under an autocracy or dictatorship, whatever the name or form or ideology on which it is based, one individual or group gains control of all resources, allowing to other individuals only such use and enjoyment of resources as may serve the purposes of the controlling group. We in America are seeking a middle way, a happy compromise between these extremes, a democratic form of society which seeks to preserve as much freedom of action for the individual as possible consistent with the common good. Through cooperative effort and through such rules and regulations as may be set up by mutual agreement, we must provide for the maintenance and wise use of our resources in the public interest.

In such a democratic society, public forests seem to be well-fitted. They are owned by the people and managed for the people. They include resources that may not be well-suited for profitable private enterprise but the proper management of which is essential to public welfare. Protection of water sources, for instance, is not apt to be a money-making activity, but it is vitally necessary in the public interest. Public management of forests may often be the best assurance of stability for communities dependent on those forests. Under public multiple-use management, all values of a forest area can be coordinately developed and managed, whereas the private exploitation of a single resource might be actually destructive of other resources of public value.

The national-forest enterprise is a cooperative endeavor, wholly in line with our democratic principles. Each citizen of the United States is a stockholder in our national forests. The citizens' representatives in Congress are the board of directors which sets up the broad objectives and policies and governs the expenditure of funds. The Forest Service has been placed in charge as manager on the ground. It is responsible to the stockholders for managing the enterprise in their interest and for production of regular dividends in the form of public benefits.

There are some who believe that all forest lands should be in public ownership. And there are some who say that all land should be privately owned. The Forest Service believes there is need for both public forestry and private forestry. Both have a place in our forest economy, and each can supplement the other.

With the increasing needs of a growing population for timber and the decline of private supply, and with increasing water problems in many areas, our national forests and other public forests undoubtedly will play an increasingly important part in the Nation's economy.

But even so, the public forests cannot do the whole job alone. Public forests—Federal, State, and community—now comprise only one-fourth of the country's commercial forest land area. The more acces-

sible and more productive forest lands are for the most part in private ownership. We must still rely on private lands for the bulk of our timber supply.

Many lumber companies, pulp and paper companies, and other industrial and individual owners of private forest land are doing a good job of forest management. But only 8 percent of all timber-cutting practice on private lands can yet be so classed. Twenty-eight percent is fair. Sixty-four percent is poor or destructive. Private forest-land resources as a whole are on the down grade. Timber is not being grown as fast as it is being used. Millions of acres of forest land are now poorly stocked or nonproductive. Many forest lands are seriously deteriorating from a watershed standpoint.

The Forest Service has repeatedly recommended measures to encourage better forest management on private lands—increased public aid in fire protection and insect and disease control; increased technical advice and assistance for forest-land owners, especially the small owners; public aid in the development of cooperative management and marketing associations of forest owners; provision for long-term, low-interest loans to help finance timber-growing enterprises; and more research on problems of timber growing and forest management.

The Forest Service also has repeatedly recommended public control of timber cutting and related practices on private forest lands, sufficient to prevent destructive practices and to assure that forest lands will be kept in reasonably productive condition. A plan for regulation by the States, with basic national standards, and with Federal financial assistance, has been proposed.

With adequate safeguards for the public interest in all forest lands, with encouragement to private enterprise in timber growing, and with full development of the public forests, our forest resources can eventually be built up and maintained to supply timber in abundance and to provide all the other benefits of well-managed, productive forests for all time.

# THE YEAR'S WORK ON THE NATIONAL FORESTS

## National Forest Board of Review

In May 1948 the Secretary of Agriculture established a National Forest Board of Review composed of private citizens to advise his office in the solution of problems arising in connection with use of the national forests by the public. The Board also will be called upon to advise on the disposition of appeals to the Secretary by forest users such as, for example, stockmen who run cattle and sheep on national-forest lands under permit, from decisions by the Chief of the Forest Service affecting their operations.

Members of the advisory group were selected on the basis of personal competence and not as representatives of any group or organization interested in the use of national-forest land. It was stipulated that members must have no financial interest in the use of this land. The Board will meet at the call of the Secretary and will be paid a salary or per diem allowances for actual time served.

Those appointed as members of the Board were Dr. Jonathan Forman, of Columbus, Ohio; Prof. Gilmour B. MacDonald, formerly

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head of the department of forestry, Iowa State College, Ames, Iowa; and Dr. Roland Roger Renne, president of Montana State College, Bozeman, Mont.

## Timber Management

**Production of timber.**—Timber cut on the national forests in sales and exchanges totaled 3,758,885,000 board feet in fiscal year 1948, a slight decrease from the record high of over 3.8 billion feet in 1947. Receipts from timber sales, however, increased from $15,400,000 to more than $20,000,000, the biggest jump in receipts ever recorded.

Marked advances in timber-stumpage prices have occurred in practically all forest regions, but particularly in the Pacific Northwest and parts of the South. The Forest Service has followed a conservative policy in appraising stumpage for sale, but competitive bidding for better quality timber where stumpage is now in tight supply has driven prices upward. More than $30 per thousand board feet has been paid for Douglas-fir in western Washington and more than $60 a thousand for old-growth shortleaf pine in Arkansas. Forest Service stumpage prices are thus a result rather than a cause of present-day prices for lumber, plywood, and other forest products. The appraised value at which timber is advertised allows a fair margin of profit and risk to an operator of average efficiency at recently prevailing lumber prices and after allowance for the estimated costs of production. Exceptionally high bids are evidence of depletion of other sources of stumpage through overrapid cutting by too many mills within the areas where such prices occur.

The rate of access-road construction is now inadequate to meet the continuing demands for additional timber from the national forests. Since special financing of road-construction projects by the National Housing Agency terminated in December 1947, access-road building has been scarcely more than enough to maintain the present level of cutting.

At the present high level of demand for forest products, opportunities to sell low-grade materials as thinnings and salvage continue. But since much of the time and effort of the available Forest Service timber-sale organization must be put in on preparing sales of badly needed prime stumpage for dependent mills, it has been impossible to take full advantage of such opportunities. Expansion of the timber-sale force would more than pay its way through increased sales of lower-grade materials that will otherwise be wasted through mortality and decay.

The present rate of timber output from the national forests has been attained through a sacrifice in needed work on management plans. Much remains to be done in obtaining adequate inventories and growth estimates that are essential for sound long-range timber management. The management-planning work is at approximately the prewar level when the annual cut was in the neighborhood of 1¼ billion feet. Current cut is more than treble this prewar rate, and management-planning activities need to be increased correspondingly.

**Alaska pulp-timber sale.**—In August 1948 the Forest Service accepted a bid for 1½ billion cubic feet of timber in the Tongass National Forest in southeast Alaska. The accepted bid was made by the Ketchikan Pulp & Paper Co., an affiliate of the Puget Sound Pulp

& Timber Co., of Bellingham, Wash. The bid contemplates the establishment of a large, modern pulp mill with an ultimate capacity of about 500 tons of pulp per day, at Ward's Cove, near the city of Ketchikan. The Ketchikan pulp-timber unit is the first of five or six such units in the Tongass, development of which is planned by the Forest Service.

This pulp-timber sale is the fruition of 30 years of effort on the part of the Forest Service to bring a pulp and paper industry to Alaska. Providing a stable major industry with year-round operation and employment, the Ketchikan development marks the first step in opening up the territory's huge pulp-timber resources, the largest untapped resources of the kind on the continent. It is expected to play an important role in expanding the economy of Alaska on a sound and secure basis.

The bid was made on the basis of a 50-year cutting contract. After 1962 prices for timber will be subject to reappraisal at 5-year intervals. Outstanding considerations in resource protection stipulated in the contract are the handling of the timber on a sustained-yield basis, the safeguarding of salmon spawning streams which are the basis of the Alaska salmon industry, the preservation of unusually fine scenic areas, and the prevention of stream pollution.

**Sustained-yield units.**—The Vallecitos Federal sustained-yield unit was established during the year in the Carson National Forest, N. Mex. The area involved—about 73,000 acres of national-forest land—will support a sustained-yield cut of 1,500,000 board feet of timber annually. The purpose of this unit is to provide a larger number of employment opportunities and longer season of employment in the local sawmill. This operation will furnish virtually the only home-town employment for the residents of three small communities. Small ranches and limited livestock production heretofore furnished only a bare subsistence livelihood.

The only other formal action during the year under the Sustained Yield Units Act of 1944 was a public hearing in March 1948 at Quincy, Calif., on a proposed Woodleaf cooperative sustained-yield unit covering certain lands in the Plumas National Forest and adjoining private timberlands. Final action on this proposal has not yet been taken. Detailed information also was prepared on a proposal for a Kootenai sustained-yield unit in northwest Montana. The proposal has attracted widespread local interest, and a public hearing may be scheduled later.

**Insect control.**—Several severe insect epidemics occurred during the year. The tussock moth outbreak in northern Idaho was completely checked by large-scale airplane spraying operations in 1947. However, the mountain pine bark beetle infestation in southern Idaho and Wyoming lodgepole pine stands continued to spread. An enlarged control project was carried on during the summer of 1948 to stop this epidemic. Most of the infested trees were treated by applications of an insect-killing penetration oil sprayed on the standing tree. This was the first large-scale use of this treating method. It was also used in national forests of the Black Hills area of Wyoming and South Dakota, where a special project was under way to check a serious outbreak of ponderosa pine bark beetle. Cooperative treatment of infested timber in the adjacent South Dakota State Park was included in this project.

## Range Management

During 1947 the Forest Service issued 3,248 pay permits for the grazing of 3,403,677 sheep, and 18,494 permits for the grazing of 1,161,905 cattle. With the calves and lambs, for which no fee is charged, and the additional stock grazed under free permit to local settlers, nearly 9,000,000 animals grazed national-forest ranges.

Grazing fees on the national forests are adjusted annually in accordance with the market price of beef and lambs for the preceding year. Under this procedure, cattle fees per head per month increased from an average of 31 cents in 1947 to 40 cents in 1948; and sheep fees increased from 7½ cents to 10 cents.

**Hearings.**—During the summer and fall of 1947 a subcommittee of the House Committee on Public Lands conducted a series of hearings in the Western States on Forest Service policies and administration of grazing on national-forest ranges. Following the hearings, the committee presented to the Secretary of Agriculture a list of six proposals relating to Forest Service procedure. The Secretary accepted four of these proposals outright. He agreed that all commitments and agreements affecting grazing permits on the national forests should be reduced to writing. He agreed that every doubt should be eliminated as to the right of grazing permittees to be represented by counsel at hearings and to receive a transcript of the proceedings. He agreed that every possible encouragement would be given to permittees to cooperate with one another and with the Forest Service in range improvements consistent with the public interest. And he agreed that consideration would be given to economic conditions affecting the livestock men's operations, the local communities, and tax structures, when reductions in numbers of livestock on the national forests are made. Acceptance of these proposals was in large measure confirmation of policies already long in effect.

A fifth proposal had to do with "impartial appeal boards." The Secretary also agreed to this proposal with the understanding that such boards should act in an advisory capacity only and would not have final authority over grazing and livestock operations on the public forests. He stated that he could not surrender the responsibility for final administrative decisions in the public interest which his oath of office and congressional acts have imposed upon him. In subsequent discussion with the chairman of the subcommittee, it was made clear that the Secretary's and the committee's views were in agreement on this point. A National Forest Board of Review was established in May 1948. (See p. 23.) Local advisory boards representing national-forest grazing permittees have been in operation for many years. Some 800 such local boards are now functioning.

The one proposal the Secretary was unwilling to accept was for a 3-year moratorium on livestock reductions on national-forest ranges. This would have meant postponement of action badly needed to stop serious deterioration of certain watershed and range lands and start them on the road to recovery. In aggregate, the planned reductions in the next 3 years will amount to very little, and will have a negligible effect on the national meat and wool supply. But unfortunately they will hit some individual livestock permittees rather hard, since the heaviest reductions obviously must be made on the most seriously overgrazed and deteriorating ranges.

The report on the 1947 hearings by the House Committee on Public Lands, issued in August 1948, reviewed a number of complaints that had been made against reductions in livestock numbers, and again urged a 3-year moratorium on reductions. The committee, however, recognized the importance of watershed protection, and stated that it was unalterably opposed to overgrazing. It was wholly in accord with the long-established policy of multiple-use management of the national forests, and opposed to sale or transfer of national-forest lands. The committee's report recommended that the Forest Act be amended to include grazing, recreation, and wildlife among the basic uses of national-forest lands, that the present policy of transfer cuts on grazing permits be discontinued, and that advisory boards on the national forests be given legal status.

The report also recommended a vigorous and greatly extended program of range improvements, with encouragement to permittees to participate. It suggested, in effect, that the Forest Service request larger appropriations for this work. This invitation the Forest Service will be very glad to accept.

**Range improvements.**—To obtain adequate improvements and facilities for efficient use of the forage resource is an outstanding problem on the national-forest ranges today. Over the years a total of about $16,000,000 has been invested for range improvements on the national forests. This is equivalent to an average of 20 cents an acre for the 80,000,000 acres of national-forest grazing land—an investment which has been wholly inadequate for developing and controlling the use of the resource. Several times this much will be required to develop each of the 10,000 grazing allotments to a point where best use can be made of the forage.

In many instances livestock numbers have had to be curtailed because facilities such as drift fences were inadequate to prevent damage to the range. There are other situations where developments such as water tanks would have made more range available to local stock growers sorely in need of summer forage to balance their ranching units.

Funds for range-development works, other than some recent appropriations for artificial revegetation, have been meager since the days of the Civilian Conservation Corps. Not only has this curtailed progress in getting the ranges in shape for efficient use but many earlier improvements are rapidly approaching a bad state of repair and will need replacement at an early date.

Fences are needed on many national-forest boundary lines in order to exclude unpermitted livestock and to prevent encroachment of permitted livestock on private lands. Division fences are needed in order to assure the utilization of feed over the entire range and to control livestock so that seasonal distribution and other management essentials may be accomplished. Most of the existing Government-built boundary and division fences were erected during the depression years of the '30's and were financed by emergency relief funds. Many of these now have to be rebuilt. Most of them are in heavy snow country and subject to the unusually rigorous weather conditions of the high country. Fences constructed by adjacent landowners also have been used as forest boundary fences, and many of these are likewise old and in need of repair or rebuilding. The landowners feel that because these fences serve as forest-boundary fence as well as to enclose pri-

vately owned land, the Government should assume half of the expense of reconstruction.

Range cannot be utilized without water. Many national-forest range areas are dry, and because of this, forage goes unused on the waterless area while livestock concentrate on and overuse the range where water is accessible. On some areas springs and seeps can be found which, if developed, will provide a source of usable water for livestock. Where there is no surface water, either reservoirs, where there is enough surface drainage to fill them, or wells, if there is sufficient ground water, must be constructed to provide stock water. When such water developments are provided, livestock can spread out, obtain unused grass, and relieve concentration areas. On some ranges more livestock can be grazed.

Of the 80,000,000 acres of grazing land within the national forests, at least 4,000,000 acres are so seriously run down that in order to restore these lands to productivity and prevent further depletion artificial reseeding will be necessary. About one-quarter million acres have been reseeded to date. Congress appropriated $793,046 for this work for the fiscal year 1949, and legislation was proposed that would continue such work until completed.

The Forest Service has spent much time and effort in developing methods and techniques for reseeding wildland ranges—one of the most difficult tasks in the whole field of agriculture. Although still more research is needed, a sound basis has been developed on which to proceed in the revegetation of many types of depleted grazing land.

## Watershed Management and Flood Control

Progress is being made in various forest regions in getting local recognition of watershed-management problems and in improving some sore spots.

At the request of the city of Grand Junction, Colo., a detailed analysis of watershed conditions was made on the Kannah Creek watershed of the Grand Mesa National Forest, which is the source of water for the municipality. The study showed that portions of the watershed have deteriorated considerably because of impairment of the plant cover and subsequent soil erosion. Adjustments in use on the watershed, especially grazing use, were clearly indicated.

In Arizona and New Mexico, field examinations were completed on two municipal watersheds, and an investigation was made of damages to surrounding lower areas from land practices on portions of one watershed. Watershed reports were made covering six different forest divisions in the region, primarily for the purpose of developing comparative watershed values in relation to future land-management activities in the counties involved.

In the Intermountain States, conditions on several municipal watersheds have been reviewed in studies in which water users, city and county officials, stockmen, and other interested groups cooperated. In some cases, local watershed committees were organized. Programs pointed toward rehabilitation of damaged water-source areas are now under way on sore spots in the Manti, Fishlake, Dixie, Boise, Bridger, and Toiyabe National Forests.

In California, particular attention is being given to the need for

preservation of natural stream values in relation to the effects which may be produced on them by large impoundments and diversions of water for important industrial uses in the valleys.

Recognition of watershed problems in the East is indicated by the preliminary watershed-management plans recently completed for the White Mountain National Forest in New Hampshire and Pisgah National Forest in North Carolina.

**Flood-control projects.**—Steady progress was made during the year in watershed rehabilitation work on four flood-control projects authorized by the 1944 Flood Control Act. Responsibility for these projects has been assigned to the Forest Service. On the Los Angeles River watershed, fire-control installations, channel developments, and some roadbank stabilization work were emphasized. The channel developments include several types of construction, such as concrete dams and cribs and metal bins. Planting for flood control and roadbank erosion control were given priority on the Little Tallahatchie and Yazoo River Basins in Mississippi. In the Potomac River watershed, cooperative timberland improvement is getting under way.

## Recreation

With a total of 21,000,000 visits reported, not including motorist-sightseers and transients, recreational use of the national forests in 1947 was up 17 percent from 1946. Winter-sports visits during the calendar year increased 38 percent over 1946.

A memorandum of understanding between the Bureau of Reclamation and the Forest Service has been signed relating to the management of national-forest lands within reclamation withdrawals. An agreement was made with the National Park Service concerning special treatment for the Grandfather Mountain-Linville Gorge area of the Pisgah National Forest.

The large recreation load at Shasta Reservoir in northern California became the responsibility of the Forest Service on July 1, 1948, as the result of legislation enacted by Congress adding lands surrounding the reservoir to the Shasta National Forest. The area involved is heavily used for recreation purposes.

Interest in resort sites and ski-lift permits has heightened. Large new developments are under way or imminent at McCall, Idaho, Berthoud Pass and Arapaho Basin in Colorado, Stevens Pass in Washington, Shasta Reservoir and Big Pines in California, Snow Basin in Utah, and elsewhere.

**Avalanche control.**—A small beginning has been made at Alta, Utah, on meeting the problem of avalanche control. Most good winter-sports areas are located in areas of some avalanche hazard. It is known that some avalanche areas can be kept under control by continuous skiing; some avalanches can be predicted by experienced men; and avalanches can sometimes be precipitated under control by explosives during a nondanger period. By controlling avalanches or by closing areas to use during hazardous periods, the chances of loss of life may be greatly reduced. The Forest Service recognizes its obligation in this respect and hopes to carry on further studies to determine the best methods of predicting and controlling avalanches so as to reduce the hazard to a minimum.

**Wilderness areas.**—Wilderness preservation was furthered by the approval of roadless areas in the Superior National Forest, Minn., by the Secretary of Agriculture. The new classification for the Superior Roadless Areas recognizes a no-cutting area around the recreationally important wilderness lakes along the Canadian border. The Gates of the Mountains Wild Area was established by the Forest Service in the Helena National Forest, Mont.

**Special-use fees.**—The Forest Service embarked on a new method of calculating permit fees for public-service resorts in the national forests. The new charges are based on net sales, and will vary with the type of business and the volume of business. The objective is still the same—to obtain an equitable return to the United States from the use of national-forest land for commercial purposes.

**Pikes Peak Highway.**—An exception to established national-forest policy was authorized by the Secretary of Agriculture in the issuance of a permit to the city of Colorado Springs to operate the Pikes Peak Highway as a toll road. The exception to the no-toll-roads policy was based on the fact that neither the State of Colorado nor the Forest Service had funds available to maintain this road, and road-maintenance work was necessary to accommodate the heavy tourist use.

**Dams.**—Among the many recreational facilities constructed in the national forests during the Civilian Conservation Corps program were a number of dams creating artificial lakes and swimming spots. The dams received little attention during the war years and a backlog of maintenance work has built up. Eleven of these dams are now in such condition that the unwatering of the reservoirs may be necessary as a safety precaution unless repairs can be made in the near future. Draining of these popular lakes and reservoirs would seriously impair the recreation values of the surrounding areas. The Forest Service hopes that funds will soon become available for the repair of these dams, and also for the completion of five others which were started by the CCC but were not finished because of the war.

## Wildlife

The Forest Service had expected to step up its wildlife development and improvement work in the national forests to the prewar level. Congress, however, did not appropriate the $162,813 requested for this work for the fiscal year 1948. In commenting on this elimination of specific funds for wildlife management, the House Subcommittee on Agricultural Appropriations said: "It is not the purpose of the committee to eliminate the functions relating to wildlife resources. It believes, however, that the function can be cared for out of other general items."

Elimination of the funds did not eliminate the problems. A special effort was made to maintain a skeleton organization of at least one man in each of the regional offices, except Alaska, to keep abreast of the major difficulties and to maintain the cooperative enterprises that are carried on with the various State fish and game or conservation departments.

**Cooperative activities.**—The Forest Service was able to continue its cooperative wildlife programs with most of the States in which national forests are located. The program in Virginia, in which the

State sells a special stamp to all of those hunting or fishing in designated national-forest wildlife management areas, is continuing to be a trail blazer in productive cooperative wildlife management. The program was more popular than ever. Four times as many stamps were sold during the past year as were sold when the project was first initiated. Satisfactory progress can be reported also for other cooperative wildlife management and demonstration areas located in the Eastern and Southern States.

Following the pattern developed in the East, the Forest Service and the State of Arizona have entered into an agreement for joint administration of the famous Grand Canyon National Game Preserve in the Kaibab National Forest as a cooperative wildlife management area.

In Montana and northern Idaho, the Forest Service and State agencies cooperated in conducting field-condition surveys on the national forests. This work is giving a much clearer picture of actual wildlife assets and problems than has ever been obtained before. The Forest Service also cooperated with these States and with Oregon and Washington in carrying out programs to provide salt for big game. In Montana, the State and the Forest Service prepared 5-year fish-stocking plans for the national forests.

In New Mexico, the State and Forest Service made final arrangements for the establishment of a herd of elk in the Jemez Mountains. In southern Idaho, western Wyoming, Utah, and Nevada a total of 95 special hunts on areas of big-game overpopulation were conducted cooperatively with the States involved. Satisfactory hunting programs have now been developed for practically all national-forest lands in these States.

A program has been worked out with State agencies of Oregon and California for management of the interstate deer herd which ranges on national forests and other lands on both sides of the California-Oregon State line.

The Forest Service was able to continue cooperating with the States in the trapping and transplanting of deer in North Carolina and Arkansas. Successful big-game hunts were carried out in these States and in Tennessee, Georgia, Alabama, and Florida.

Some of the Central States, such as Missouri and Indiana, were able to report very sizable increases in the number of deer on the national forests. In Illinois the Forest Service created additional small fish ponds by requiring that holders of special-use permits for borrow pits leave their operation in such a condition as to hold a permanent supply of water. Forest-management practices, both harvesting and reforestation, in Michigan national forests were reoriented, with the requirements of a productive wildlife habitat given increased consideration.

## Forest-Fire Control

At no time of the year are all parts of the country free from danger of forest fires. Even in a year most favorable from the standpoint of total losses, fires may occur that are disastrous to some local communities.

In such relative terms, the number of forest fires and the losses suffered in the national forests during the early part of 1948 were low.

There were serious fires in California later in the season, but the full record for 1948 and its significance will have to await later appraisal. Consequently, the conditions and experiences of 1947 will serve best in a review of recent work and accomplishments.

**1947 season.**—Some regions experienced relatively easy fire weather conditions in 1947, but others had some of the most dangerous weather in years. One of the worst drought periods in decades developed in Arizona and New Mexico. Similar prolonged dry periods were experienced in Nevada and southern Idaho. Extraordinarily dry periods of shorter duration occurred in the New England States, and in Texas, Louisiana, Illinois, Missouri, Arkansas, Wisconsin, and Michigan. Although the severe fires in the States of Maine and Texas did not do appreciable damage to national-forest lands, they did great damage to State and private lands and property, and illustrate the severity of the fall fire season in those areas.

The 1947 fire season in California rated among the four driest on record. The low winter snow pack and the dry spring, summer, and fall periods had their impact on fire-suppression activities, particularly in the national forests south of Redding. For successful control small fires had to be attacked fast and hard, and large fires proved very difficult to handle, requiring full emergency mobilization of all available equipment and manpower from large areas.

During 1947 a total of 11,225 forest fires in the national forests were controlled by the Forest Service. Of this total 6.815 were reported to be man-caused and 4,410 caused by lightning. All told, there were fewer lightning fires than usual during 1947. But in Montana and northern Idaho 1,321 lightning fires occurred in a 52-day period, resulting in a serious strain on all fire-fighting facilities, which offset otherwise favorable conditions in this region.

Fires in 1947 burned 187,006 acres of national-forest lands and 67,407 acres of privately owned lands inside national-forest boundaries. In terms of acres burned the 1947 record was not unusual, but costs and damages were the highest experienced since the prewar period.

Labor for fire fighting continued to be a serious problem. Where fire emergencies developed and it became necessary to recruit labor from industrial or other centers, quality and performance were unusually low. Fieldmen report performance at 60 percent or less of what it was 15 years ago. This low output, at current fire-fighting wage rates, increased the difficulty of attaining efficient operation and greatly increased the cost.

Excellent cooperative relationships with other Federal, State, county, and private agencies in matters of fire prevention and suppression continued to be the rule in 1947. Forest permittees, particularly the stockmen and timber operators, did everything in their power to assist the Forest Service in the suppression of fires. The armed services and the States, counties, and municipalities came through with aid in a number of instances when the going got "tough."

**Increased use of equipment.**—Use of specialized equipment in the control of fires is increasing each year. Mechanized trail builders and tank trucks again demonstrated their value as suppression vehicles. Airplanes were used extensively. In the California region a total of 86 different planes of varied ownership participated in fire-suppression work during the year. Helicopters were used successfully on a large fire-suppression job for the first time this year in California.

Results indicate this machine may solve many problems of fire fighting in rugged terrain and inaccessible country.

Radios, power felling saws, and many other pieces of fire equipment also contributed increasingly to the efficiency of fire suppression work.

**Smoke jumpers.**—The delivery of trained fire fighters to forest fires in back-country areas by airplane and parachute has continued to demonstrate its value. For the most part "smoke jumper" operations in 1947 were confined to national-forest areas in Montana, Idaho, Washington, and Oregon, with small-scale operations in northern California; but a new operation was started on a trial basis in New Mexico. Initial attack was made on about 200 fires by parachute fire fighters. Air-borne fire fighters prevented many potentially bad fires from becoming large. In northwestern Montana a total of 75 smoke jumpers jumped to a single fire and were responsible for the control of a serious back-country fire at a relatively low acreage. This mass attack from the air was an innovation. Usually, when a fire got too big for a few smoke jumpers to handle, ground crews were brought in as reinforcements. Sometimes delay in getting reinforcements by usual means has resulted in serious losses. When available, quick reinforcement by air may therefore be invaluable.

**Fatalities.**—Four lives were lost fighting forest fires in 1947. Two men died of injuries suffered while engaged in fire fighting, and two men were burned to death on a fire on the Angeles National Forest in California.

**Flood damage.**—The 1948 floods in the Columbia River Basin caused damage estimated at some $6,000,000 to national-forest property and improvements. An additional $4,800,000 damage to intermingled and adjacent private property was reported. On the national forests alone, 500 bridges were wrecked or impaired, 4,300 miles of roads were cut by wash-outs, and 980 miles of communication lines were disrupted. This heavy damage had Forest Service fire-control men in the Pacific Northwest greatly worried as they entered the 1948 fire season. Until disrupted transportation and communication facilities could be repaired, fire-control operations would be seriously handicapped. Congress made a special appropriation to meet the emergency.

## Improvements and Facilities

**Forest-development roads and trails.**—During the fiscal year 1948, expenditures on the national-forest road and trail system approximated $19,000,000. The appropriation for this work was $11,000,000; the balance consisted of $1,800,000 of 10-percent road funds and about $6,200,000 of funds transferred to the Forest Service by the National Housing Agency for the construction of roads to stands of Government timber.

Including the Housing Agency funds, about $11,500,000 was used for improvement and construction of timber-access roads. This completed about 1,100 miles.

Maintenance work to preserve the investment in the transportation system and to provide for reasonable service to traffic essential for protection, administration, and utilization of the national forests was accomplished on about 76,000 miles of roads and 100,000 miles of trails at a total cost of approximately $7,500,000. Nearly $1,500,000 of this

was used for replacement of bridges. Bridge repair or replacement is currently representing an unduly large portion of the annual maintenance work due to the many short-life timber structures built during the Civilian Conservation Corps program under restrictions then in force limiting purchase of materials.

**Water resources.**—During the past year the Engineering Division of the Forest Service, in cooperation with the Federal Power Commission, administered power projects on the national forests whose output was valued at more than $25,000,000. There has been unusual activity in power and other water-use developments since the end of the war and indications are that this will continue.

In addition to power dams, six irrigation-water supply dams were approved for construction on the national forests.

**Aerial photography and mapping.**—Approximately 3,640 square miles of planimetric mapping were completed in the northern, Pacific Northwest, and California regions. Approximately 15,929 square miles of aerial photography were placed under contract in western regions.

## National-Forest Properties

On June 30, 1948, the 152 national forests, 43 purchase units, 17 experimental forests or ranges, and 11 land-utilization projects administered by the Forest Service included a gross area of 228,936,105 acres and a net area of Federal land subject to Forest Service management of 179,764,502 acres. This net area was 449,746 acres greater than on the same date in 1947.

The Montezuma National Forest in Colorado was abolished and the lands therein made parts of the Uncompahgre and San Juan National Forests in the same State. This action was taken in the interest of administrative efficiency and economy, after a determination that the lands could be administered as parts of the other two national forests without detriment to the resources or undue loss of public service. A gross area of 2,400 acres, of which 920 acres were owned by the United States, was added to the Fishlake National Forest in Utah by public land order.

**Land purchases.**—For fiscal year 1948, Congress appropriated $750,000 for purchase of lands under the Weeks law of March 1, 1911, a decrease of over 70 percent from the appropriation for fiscal year 1947. A net of $136,686 was also appropriated under the several "receipts acts" to meet the acquisition problem on certain national forests not subject to the Weeks law. Pursuant to such appropriations, a total of 431 tracts comprising 96,250 acres were approved for purchase under the Weeks law, and 13 tracts involving 7,240 acres under the receipts acts. These purchases were situated in 41 national forests or purchase units in 25 States and Puerto Rico. With the exception of the Arrowrock unit in Idaho, in which 6,154 acres were approved for purchase, the purchases under the Weeks law were in units east of the Great Plains. Purchases approved under the receipts acts were in national forests in Utah and California. While the appropriations were too small to make any substantial progress on the large land-acquisition job necessary to consolidate and build up the national-forest properties to maximum effectiveness, they were, never-

theless, of substantial assistance in the purchase of key properties and in consolidating some of the purchase areas.

**Exchanges.**—In addition to purchases of land, 152 applications to exchange privately owned land for national-forest land or timber were received and acted upon. During the year title was accepted to approximately 331,000 acres of land which had been offered to the Government in exchange. For the land so accepted approximately 48,000 acres of national-forest land and 308,000,000 board feet of national-forest timber were or will be granted.

**Boundary extensions.**—During the fiscal year the Congress passed and the President approved several acts extending the boundaries of the national forests. Public Law 339 extended the boundaries of the Modoc National Forest in California to include about 37,433 acres, mostly privately owned timberland. Public Law 449, effective July 1, 1948, added 108,000 acres, more or less, of public lands surrounding Shasta Lake of the Central Valley project in California to the adjacent Shasta National Forest, and extended the exchange act of March 20, 1922, to the intermingled non-Federal lands. The purpose was to assure protection and administration of the watersheds tributary to the reservoir, management and restoration of timber, and administration of the recreational resources of the lake and surrounding land. Public Law 650 added a gross of 70,733 acres to the Caribou National Forest in Idaho for the purpose of promoting watershed conservation and integrated use of the land with adjoining national-forest areas. Public Law 719 added to the Nicolet National Forest in Wisconsin, upon concurrence of the directors of the Wisconsin Rural Rehabilitation Corporation, 680 acres of timberland acquired for the United States by that corporation and recently assigned to the Lakes States Forest Experiment Station as a research area. The actions of Congress in thus extending the national forests are most helpful in accomplishing the broad programs of watershed and timber conservation.

Of considerable importance also is Public Law 733, which authorizes exchanges of lands in the Shipstead-Nolan Law area (46 Stat. 1020) within the Superior National Forest in Minnesota, and the appropriation of $500,000 to purchase privately owned lands within a specified portion of that area. The chief purpose of such purchases is to preserve the natural character of the wilderness lake area, which is fast being destroyed by numerous commercial resort and cabin developments on private lands within the wilderness area.

## COOPERATION IN STATE AND PRIVATE FORESTRY

### Forest-Management Assistance to Woodland Owners

Of the 345,000,000 acres of commercial forest land in private ownership in the United States, 75 percent is in small holdings, averaging about 62 acres each. These small holdings include some of the best land for providing continuous crops of commercially valuable and readily accessible timber. Generally, they are overcut and understocked. As old-growth forests disappear, second growth from the small woodlands must be the source of a large share of the forest-products supply of the future. The small woodlands must be made and kept productive.

To aid woodland owners in applying good management to their timber holdings, 173 farm-woodland-management projects were in operation during fiscal year 1948. They are conducted in cooperation with 40 States under terms of the Cooperative Farm Forestry (Norris-Doxey) Act of 1937. The Forest Service and the States share the costs of these projects, in each of which a forester is made available to advise and assist woodland owners on timber-management and marketing problems. On July 1, 1948, all projects were placed under State direction on a Federal reimbursement plan of financing similar to the cooperative fire-protection and tree-distribution programs.

In fiscal year 1948, 14,220 individual small owners were helped to apply improved management practices on 1,399,971 acres of woodland. Under advice of the project foresters 503,641,000 board feet of sawlogs and other products were harvested. The woodland owners received $7,668,499. Included in this forest harvest were 4,803 barrels of gum for naval stores and 66,670 gallons of maple sirup. The project foresters assisted some 5,500 small sawmill owners and other small forest-products operators in forest-marketing problems relative to products from small woodlands. There were 2,558 unfilled requests for service from individual woodland owners at the end of the year.

Of the 2,000 counties in the United States that contain sizable amounts of farm woodland, some 750 now have technically trained project foresters available. Many more "Norris-Doxey foresters" will be needed if all counties with small privately owned woodlands are to be served.

Technical foresters working out of the regional offices of the Forest Service or cooperating in State foresters' offices continued to furnish assistance to individual owners of numerous large and medium-sized holdings. Constant progress is being made even though such expert technical assistance always has been limited. Many large owners and some with medium-sized woodlands have employed trained foresters or engaged private consulting foresters to advise and assist them in the wise management of their forests. Here the technicians of the Forest Service work with the foresters concerned on technical procedures and standards rather than actually assisting on the job in the woods.

## Farm-Forestry Extension

The Forest Service works closely with the Department of Agriculture's Extension Service in conducting educational programs through the State agricultural extension services of the land grant colleges designed to build up interest and stimulate action in growing timber as a crop on the farm. The Federal Extension Service employs two extension foresters who serve in a liaison capacity with the Forest Service, coordinate the programs between States, and serve as channels for distributing forestry information prepared by the Forest Service to the State extension foresters and through them to county agricultural agents and farmers.

The 45 States and 2 Territories cooperating with the Department in farm-forestry extension employ 65 extension foresters. Through the State extension organizations and county agricultural agents, the extension foresters work to encourage woodland owners in recognizing forestry problems and in applying improved woodland-management

practices. Various educational means are used, such as demonstrations, meetings, leaflets, radio, and the press. Extension cooperation also is given to State forestry departments in the distribution of tree planting stock, demonstrations on how to plant trees, and in the stimulation of interest in the control of woods fires. By developing forestry projects for farm youth much interest has been aroused in better care and management of farm woodlands, in wildlife conservation, and in farmstead protection.

The State-wide programs of the extension foresters have helped to pave the way for the direct on-the-ground service to individual woodland owners provided by the Norris-Doxey farm woodland management projects previously mentioned.

## Cooperative Tree Distribution to Farmers

In fiscal year 1948 there was a continued and widespread interest in farm tree planting. Forty-two States and two Territories cooperated with the Forest Service in the production and distribution of forest-tree planting stock under terms of the Clarke-McNary and Norris-Doxey Acts. State expenditures exceeded by six times the Federal appropriation of $124,600 available for this work. Many of the States were still unable to fill all orders for planting stock.

More than 42,000,000 seedlings and transplants were distributed at cost or less to farmers for planting for windbreaks and shelterbelts, for timber production, or for erosion control. This was considerably less than the number expected to be available for distribution because there were problems of seed shortages, labor inadequacy, failures in nursery production due to floods and drought, and delays in expansion of nursery facilities. There are now 73 State tree nurseries and 10 in the 2 Territories operating under the cooperative program. Total capacity is estimated at 388,000,000 seedlings for the States and 14,000,000 for the Territories, or a total potential capacity of 402,000,000 seedlings a year.

Production of planting stock for 1949 is estimated at about 200,000,000 seedlings. Some States will arrive at full production; others will be several years reaching capacity. Deficiencies in equipment and funds are now the chief factors limiting production. Demands will be far in excess of the available trees, and a practical program of 1,000,000,000 seedlings per year is a desirable goal. Even at this rate it would take about 40 years to accomplish the job of planting the estimated 44,000,000 acres of farm lands that should be in trees.

## Naval Stores Conservation Program

The year 1948 was the thirteenth consecutive year in which a Naval Stores Conservation Program has been in effect. This is a part of the general Agricultural Conservation Program set up under the Soil Conservation and Domestic Allotment Act. Its administration has been delegated to the Forest Service by the Production and Marketing Administration.

The beneficial effect of this program extends to the entire forest resource of the naval stores region, comprising about 50,000,000 acres of productive forest land. Turpentine farming represents the great-

est single use of land in the deep South, and the greater part of this extensive forest area is directly controlled through ownership or lease by gum naval stores producers.

The program provides small benefit payments to turpentine operators who meet certain requirements of performance. Its objective is to encourage sound conservation practices in naval stores operations. In the earlier years the performance requirements were directed mainly to prohibiting the turpentining of undersized trees, with the result that this once widespread uneconomic practice has now been almost entirely eliminated. In later programs performance requirements have been enlarged to promote better cutting practices, improved fire protection, selective-cupping practices to improve growing conditions in timber stands, and the promotion of the use of chemical stimulants to prolong gum flow from turpentine faces. The 1948 appropriation for this program was greatly reduced, but the continuing interest and participation by producers has been maintained.

## Cooperative Fire Control on State and Private Forest Lands

Federal cooperative assistance in the prevention and suppression of forest fires on State and privately owned forest lands is continuing, under authorization of the Clarke-McNary Act, in 43 States and Hawaii. During calendar year 1947 organized protection against fire was provided for 328,000,000 acres, an increase of 9,000,000 acres over 1946. Gradually, control of wild fires is being extended and intensified. But there still remain 111,000,000 acres of privately owned forest lands needing protection but as yet receiving no organized fire control whatever. The present degree of protection in many other areas is below what is considered essential for good forest management.

Congress raised the Federal appropriation for cooperative fire protection from $8,300,000 in fiscal year 1947 to $9,000,000 for fiscal year 1948. This is the ceiling of the present authorization. Cooperating States spent $13,317,000 of State and private money in the cooperative protection program during calendar year 1947, an increase of 24 percent over similar expenditures during the previous year.

At approximately 5-year intervals the State foresters and the Forest Service jointly work up a detailed estimate of the non-Federal areas in need of fire control in each State and the cost of establishing a basic level of necessary protection. In 1938 this survey indicated that an annual expenditure of $18,000,000 would be required to handle the job in all important forested States. On the assumption that the Federal Government would share half the cost, this 1938 estimate was the basis for the present Clarke-McNary authorization of $9,000,000. The latest comprehensive survey, made in 1945, showed that the protection job on the 439,000,000 acres of non-Federal forest and important watershed lands needing organized fire control would cost approximately $32,000,000 per year. It is now estimated that protection of these areas would cost about $40,000,000 a year, of which the Federal Government's share would be $20,000,000. The substantial increase in estimated cost since the 1938 and 1945 calculations is largely due to further increases in wages, salaries, cost of equipment, and other items needed in the protection effort. The increase is also partly due to a

more comprehensive and careful determination of protection needs and the inclusion of over 16,000,000 acres of important nonforested watershed areas not embraced by the 1938 estimate.

In 1947 (latest year for which complete reports are available) fires burned 2,814,381 acres, or less than 1 percent of the protected area of State and private forest land. This exceeded by 561,586 acres the area burned during 1946—a more favorable year. Number of fires on protected lands increased from 66,103 in 1946 to 71,442 in 1947. Southeastern Texas, Louisiana, and southern Maine suffered unusually high fire occurrence and acreage burned. But although 9 percent more fires occurred on the protected area in 1947 as compared with the previous 5-year average, they burned 132,300 fewer acres.

Dependable figures are not available for the 111,000,000 acres of unprotected forest lands, but the best estimates of State men most familiar with the situation indicate that about 18 percent of the unprotected areas burned over in 1947, or more than 20 times the relative burn on areas which received organized fire control.

Damage estimates for both protected and unprotected forest lands are known to be unduly conservative because they often fail to include full tangible losses and completely ignore the many intangible and indirect damages resulting from forest fires, such as those caused by decay of fire-damaged timber, replacement of desirable tree species by less desirable ones, soil deterioration and erosion, uncertain stream flow, destruction of game habitat, interruption of tourist use, and the like. However, the damage figures reported for 1947 were $21,378,477 on the protected area and $30,856,385 on the unprotected, or a total of $52,234,862, as compared to $31,347,216 in 1946. The disastrous Maine fires accounted for a large part of this increase.

Cooperating States have made substantial progress in expanding protection to unprotected private forests since World War II. Twenty-five million acres have been added to the protected area. Extending protection to the 111,000,000 of unprotected lands as rapidly as possible is the high-priority unfinished job in this Federal-State cooperative program.

## Community Forests

The past year registered a phenomenal increase both in number and in area of county, municipal, school, and other community forests. The number of community forests now reported is 3,113 and the area has increased to 4,413,950 acres. This is an increase of 25 percent in number and 28 percent in area in a single year.

The Forest Service is cooperating with State forestry agencies in encouraging the establishment and development of community forests. The additions of the past year were mainly in the lists of county and public school forests. Large additions to the areas in county forests were made in Minnesota, Oregon, and Wisconsin. A number of these have been dedicated as living war memorials to the men and women of the armed forces. Marked increases in the numbers of school forests occurred in Florida and Michigan. Michigan now leads all of the States in the number of community forests, having reported 846, of which 627 are school forests. Many of these are used as outdoor laboratories in connection with the school work.

# FOREST RESEARCH

Although no additional research centers were established by the Forest Service during the year, work at those already in operation was alertly carried forward. Some of the newer research centers are in areas where there are no national forests. In the establishment of experimental forests within such research-center territories, the interest of industrial and State and private institutions has been very gratifying. Cooperative agreements for the use of State lands were made in Minnesota and Iowa; for the use of industrial holdings in Pennsylvania, Virginia, Washington, Alabama, and Georgia; and for the use of lands belonging to a college in New York. Not only does the cooperative use of the land make it possible to carry on experimental work, but the forests will serve as demonstrations and will help to interest other landholders in sustained-yield management on their properties.

At several of the regional forest experiment stations, cooperative studies have been undertaken that pool the interest and information of a large number of industrialists, State forestry officials, forestry-school personnel, and the Forest Service. Among these is the study of control of spruce budworm in New England. Here large paper companies and others have made their lands available for the establishment of experiments in silvicultural methods aimed at reducing budworm damage.

A council representing all interested parties has been formed to advise the Forest Service's Northeastern Forest Experiment Station and to help get into practice the measures indicated by its research.

In the Pacific Northwest, where second-growth Douglas-fir is coming into first importance, a "town hall meeting" of Douglas-fir foresters was held in March 1948. As a result of this meeting the Pacific Northwest Forest and Range Experiment Station organized a nine-man committee representing the forestry schools, industries, and State and Federal Forest Services to promote experimental work in the management of second-growth Douglas-fir. The committee has prepared a report bringing together all available information on the subject, which is already in wide use and great demand. The report will form the basis on which additional research work will be undertaken, and will be revised from time to time as new experience becomes available.

## Forest Management

**Harvesting and reproducing the forest.**—Information and experience on a number of important forest types was rounded out and fitted together during the year. Notable among them was the ponderosa pine type, in which all of the western forest experiment stations are concerned.

The California station has now completed initial cuttings in virgin ponderosa pine stands over most of the Black's Mountain Experimental Forest. These initial cuts aimed to remove, first of all, the trees most likely to be susceptible to bark beetle attack. They have reduced the mortality during the 6 years since the cutting began to less than one-fifth of that in the virgin forest. The light partial cuttings also have increased the rate of growth beyond the expected

capacity of regulated stands in some cases. At the Pacific Northwest Station emphasis has been placed on vigor classification in the selection of ponderosa pine trees to be cut. Here again the use of light cuts is proving satisfactory. The value of such cuts was further proved at the Northern Rocky Mountain Station, where examinations of 35-year old cuttings showed that the lightest cuttings were followed by the greatest increase in growth. However, there is evidence of a slowing down of growth rate in these old cuttings, indicating that the stands should be worked over again to remove the slower growing individuals. In general there seems to be evolving a system for the handling of the widespread ponderosa pine type, which involves, wherever it grows, light, frequent cuttings.

During the year, the Forest Service published a circular on the management of red pine in Minnesota, presenting the results of studies by the Lake States Forest Experiment Station on this species. Red pine, which formed an important component of the famous virgin pine forests of Minnesota and the other Lake States, is of rapid growth and comparatively free from insect pests and diseases. It produces high-grade lumber, and the natural second-growth stands have been augmented by large areas of forest plantations. The Lake States Station's and cooperators' studies indicate that intensive management of red pine stands requires frequent thinnings and light improvement cuttings, followed at the end of the rotation by reproducing the stand by the "shelterwood" method—that is, removal of the mature timber in a series of cuttings so that natural reproduction may become established under the partial shelter of seed trees. Natural reproduction may be increased if the ground is scarified prior to the seed fall. It was found that the older method of seed-tree cutting (leaving only a few seed trees per acre) often resulted in good forest land being taken over by brush.

Research is showing that in many instances sound forest management is the best means to minimize damage to timber stands from insects and diseases, and to decrease control costs. The Northeastern Forest Experiment Station's work with the spruce budworm has been directed toward improving methods of cutting in northern coniferous stands. Overmature and decadent balsam fir is especially attractive to this insect, and prompt removal of these trees not only tends to immunize the stand from severe attack but renews the vigor of the younger, better trees in the forest. In the southeastern region, it is becoming more apparent that the baffling "little leaf" disease of shortleaf pine is somehow related to the nutrition of the trees. If this is so, it is quite possible that silvicultural practices aimed at improving soil conditions may be a means of alleviating the trouble.

**Improvement cuttings.**—There has been much interest in the use of chemicals to control unwanted forest "weed" trees. A number of chemicals which became available during the war are being tested at the Southeastern Station and elsewhere. The effectiveness of chemicals varies with the season, size of trees, and species. Costs seem to compare favorably with other less satisfactory methods of controlling unwanted vegetation. However, the long-time effect of the changes caused by the use of chemicals is not known, and their widespread use cannot yet be recommended.

Studies at the Southern Station indicate that removing low-grade hardwoods in pine-hardwood stands is one of the most effective fores-

try measures a landowner can take. Even in areas where hardwoods are unsalable, the increased growth of the pine soon pays for the cost of the treatment. Experiments showed that heavily treated stands produced 17 times as much volume of pine in the first 7 years after treatment as did lightly treated stands.

**Planting.**—Research is adding new findings and new experience to the solution of such problems in tree planting as the choice of species for various sites, the spacing of trees, season for planting, site preparation, and the best kind of nursery stock to use. Machines have been adapted to the planting of many of the sites in need of reforestation, and the labor requirements of forest nurseries are being reduced by the use of mechanical cultivators, transplanters, and stock lifters, and by chemical weeding.

During the year, the Forest Service issued a Farmers' Bulletin on tree planting in the Central, Piedmont, and Southern Appalachian regions, which summarized findings from a number of years of study at the Southeastern and Central States stations. A similar bulletin is being prepared for the New England and Lake States regions and another for the Southern States.

Although the airplane is already used extensively for seeding agricultural crops, the method is of limited usefulness in reforestation work because site preparation and control of rodents is quite essential to any successful direct seeding operation. However, immediately after a severe forest fire, conditions may be such that seeding from the air can be accomplished successfully. Rodents will have been killed or driven from the area and competing vegetation destroyed. The severe fires that occurred in Maine in 1947 presented both need for reforestation and opportunity for experimental work. The Northeastern Station made the best of this chance by undertaking an airplane seeding experiment on the Massabesic Experimental Forest near Alfred, Maine, in February 1948. Seeds were sown from the air in densities ranging from 4,000 seeds per acre up to 60,000. At a density of 8,000 seeds, the cost per acre ran about $3. With present high cost of planting stock and prevailing wage rates, planting white pine trees by hand would have cost at least $35 per acre. Comparisons of cost mean nothing, of course, until the success of the seeding is known. Already, however, there are indications that a good crop of young trees will result. But good luck may have been a big factor in the success of the operation. The seeds fell on a blanket of soft snow which prevented them from drifting, and another fall of snow that came soon after hid the seeds from birds and animals that might have eaten them.

**Protection.**—Forest research turned to some of the fundamentals of physics and human physiology in a study of some principles of visibility and their application to forest-fire detection. A report published during the year brought out important findings about the human eye as an optical instrument, about atmospheric haze, and about their effects on the ability of lookout men to see and recognize smokes from forest fires. Among the practical developments reported were various visibility meters which make it possible to measure the amount of haze in the atmosphere and then to calculate the distance that smokes can be seen. Based on the fact that haze polarizes light, an instrument was developed with which smokes invisible to the unaided eye can be seen. A simple, reliable eye test for lookout men was devised. The report also covered the characteristics of

binoculars, telescopes, haze filters, and goggles and their usefulness for lookouts, and the best designs for lookout houses to make fire detection as easy and sure as possible. In an appendix the mathematical theory on which these developments are based is given in enough detail so that physicists may make use of it to further advance this kind of research.

**Genetics.**—Recent work at the Institute of Forest Genetics at Placerville, Calif., a branch of the California Forest and Range Experiment Station, has been marked by the mass production of hybrid pine seeds and the development of nursery stock of these hybrids for large-scale testing under forest conditions. Among the hybrids now ready for testing are various crosses between ponderosa pine and its near relatives, Jeffrey and Coulter pine; crosses between jack pine and lodgepole; and between eastern and western white pines. Several of the hybrids being tested show hybrid vigor—that is, they grow faster than either of their parents. Others combine rapid growth of one parent with hardiness of the other. They can be grown beyond the natural range of the fast-growing parent. The regional experiment stations are establishing plantations to test these hybrids.

## Forest Influences

**Columbia River flood.**—A crew of Forest Service watershed specialists was dispatched to the Pacific Northwest in May 1948, before the flood in the Columbia River Basin had subsided, to make a survey of flood damage to national-forest property and to study the relation of watershed conditions to the flood runoff.

Immediate causes of the flood that inundated Vanport, Oreg., parts of Portland, and other cities, towns, industrial developments, and farms, took more than 40 lives, made 60,000 persons homeless, and caused some $200,000,000 of property damage, were the extraordinary weather conditions prevailing over most of the basin. Abnormal accumulations of snow, a late spring, then prolonged rains and a sudden unseasonable hot spell that quickly melted most of the snow sent high water streaming down from snow-covered highlands in all parts of the basin. However, the watershed technicians found ample evidence that damage in the upland valley areas would have been far less severe and that considerable water would have been held back until after the flood peaks had passed, if millions of upland acres had not previously been depleted of their plant and forest cover, mainly by forest fires.

Striking evidence that forests slow the rate of snow melt and thus delay high water flows such as contributed to the floods was observed by the investigators. As late as June 14, about 15 days after the flood peak, timbered areas in the uplands were seen to be still blanketed with snow, while nearby burned-over sections were snowless. This was particularly apparent at higher elevations. In many instances, burned and denuded north and east slopes, that normally should hold their snow longest, had lost all their snow, while timbered south and west slopes were still snowbound.

Rough ground measurements on a number of small drainages showed peak discharges from severely burned or otherwise disturbed drainages averaging 50 percent higher and in some cases nearly 100

percent higher than those from unburned ones of similar elevation and topography. Runoff from burned, logged, or overgrazed drainages also carried more debris, caused more channel and bank cutting, more sedimentation in lower streams, and damage to roads and bridges.

Forest fire has been the most important factor in denuding millions of watershed acres in the Columbia Basin. Logging, grazing, farming, mine or smelter operations, and road building, where done without apparent consideration for watershed values, were other causes. The report of the investigating group pointed out that flood damage traceable to poor watershed conditions demonstrates the urgent need for maintaining and improving fire protection, and the wisdom of large-scale forest planting and range reseeding operations in the basin highlands, for reduction of floods as well as for timber and forage production.

**Survey units.**—In order better to carry out its responsibilities in the flood-control program, the Forest Service established new watershed survey units at the Northern Rocky Mountain and Southern Forest Experiment Stations. The primary responsibility of the western unit will be for surveys in the upper Missouri and upper Columbia River watersheds; that of the unit in the South will be primarily for streams tributary to the lower Mississippi. In carrying out the flood-survey program on assigned watersheds, the Forest Service cooperates closely with a comparable organization in the Soil Conservation Service.

These surveys are revealing that many of the stream channels are now badly eroding, and in those areas where heavy timber cutting has taken place, the channels are in a serious condition. Consequently an extremely costly remedial program of engineering aid will be needed if the forest areas are to provide maximum protection to the water resource.

**Watershed research.**—Research activities in watershed management progressed materially during the year. Help was given to States, counties, and municipalities and to quasipublic institutions such as city water companies.

A Nation-wide conference of forest-influences research men was held in May 1948 at the Coweeta Experimental Forest in North Carolina. This conference, the first in 10 years, enabled the investigators to unify efforts, achieve better correlation in research methods, and discover current deficiencies in programs. Outstanding was the demonstrated need for greater emphasis on soil research as well as for more work on snow accumulation and melt, particularly as related to forest-cover conditions.

That watershed research is greatly valued has been forcibly demonstrated. When because of insufficient funds the question arose as to whether the San Dimas Experimental Forest could continue in operation, the State of California made a special appropriation to continue the work. In addition, the State forester has undertaken to finance a series of publications summarizing many of the results of work already done.

For several years the Interstate Commission on the Delaware River—"Incodel"—has, in cooperation with the State of Pennsylvania and other public and private groups, sought congressional recognition of the need for studies of forest and water relations in this area. In

order to get this work started promptly, Incodel, in cooperation with the State and other agencies, procured an experimental forest and turned it over to the Northeastern Forest Experiment Station. A dedication ceremony was held on this area in May following news that the Congress had provided funds for beginning research on Delaware Basin problems in fiscal year 1949.

The effect of the shelterbelts on snow in the Great Plains region has stimulated thinking that there may be large opportunities to save water that might otherwise be lost in semiarid regions. Shelterbelts planted at right angles to the prevailing winds at high elevations in relatively open areas would accumulate snow throughout the winter. Then, protected by trees, melt would be greatly delayed and water would be made available for later spring or early summer flow. Trials already show possibilities. In Utah, using snow fences as shelterbelts, snow has been accumulated to great depths. The snow became very dense and remained unmelted for weeks after other snow has disappeared.

Evidence is also accumulating that frost in the soil is a most important factor in spring floods such as are common in the Northeast and Ohio Valley regions. The soil of burned, logged, or trampled areas usually freezes, sometimes quite deeply, in early winter. This frost often persists even under a heavy snow blanket, so that any thaw results in immediate and rapid runoff. On the other hand, forest soils which have not been disturbed and which have a good mulch of litter and humus, are not so likely to freeze. Instead they retain their open, porous character. If they do freeze, the frost in the soil is of a honeycomb or crystalline character which, during a sudden thaw, permits the water to infiltrate into the soil. Measurements taken in the Northeastern States for the past several winters indicate that the presence or absence of soil frost and its character is probably more responsible than any other one factor in determining whether a thaw will or will not produce a flood.

Research at Coweeta continued to demonstrate that abuse of the forest is at the root of many serious water and soil problems. Building of logging roads in the southeastern mountains usually means operating a bulldozer up a slope at the highest possible angle the machine will work. As a result roads are "pushed out" by the bulldozers often with grades in excess of 20 percent. Few drains are put in such roads and no effort is made to hold the loosened soil. As a result, the quality of the water in a stream reflects almost immediately the presence of a logging job. Repeatedly, streams that had contained only a very few parts per million of solid matter when their watersheds were undisturbed, jumped to several thousand parts per million with the advent of logging. And such turbidity does not clear up with the cessation of logging. Instead it continues indefinitely because the raw sores of skid trails and logging roads continue to erode long after timber cutting has ceased. Logging that is done without regard for the water resource—and most logging in the Southeast is done that way—is perhaps the greatest single contributing cause of flashy floods, eroding channels, and declining fishing. No solution to this problem, even on the national forests, has yet been found. On the national forests it probably lies in greater insistence by the Forest Service on carefully planned and supervised logging operations.

## Range Research

Research in the management and improvement of range lands continues to yield knowledge useful in increasing forage and livestock production. The Forest Service range-research program includes determination of the relative grazing values of various range plants, of desirable seasons to graze various types of range, of grazing capacity on different range types, and of utilization standards or guides to range conditions and trends. It also includes study of the suitability of different types of range for various kinds and classes of livestock, the management of livestock on the range, restoration of depleted range, and other matters affecting sustained high forage and livestock production.

**Better management procedures.**—On the Jornada Experimental Range in the semidesert country of New Mexico, where annual rainfall averages only about 8 inches, beef production per breeding cow has been almost doubled through good range and cattle management. In the early 1920's, calf crops on this range averaged approximately 74 percent and calves weaned at about 275 pounds. Even these figures were above the range average for southern New Mexico. During the past few years, calf crops on the same area have averaged 90 percent, and the calves 411 pounds at weaning. This increased production has come about chiefly through better management procedures developed from research: More conservative stocking, deferred grazing of parts of the range, better seasonal use generally, and the use of supplemental feeds during drought periods and at other times when they were economically desirable.

Increases in production have also been secured experimentally with cattle in the plains of eastern Colorado and in the foothills of California, and with sheep on desert winter ranges in Utah. Worth-while leads to better management practices are continually coming from the range research.

The advantages of moderate as compared to heavy stocking, aside from larger calf crops, heavier calves at weaning, lower feed costs, and higher salvage values of cows, have become evident after 14 years of contrasted grazing in the northern Great Plains near Miles City, Mont. Soils on the heavily grazed areas were more compact, with less pore space, and had only one-third to one-half as much litter as on soils where grazing was moderate or light. As a result, the soils of the moderately and lightly stocked ranges absorbed water from two to four times faster than those of the heavily stocked ranges. Moderate grazing by cattle permits greater absorption of rainfall into the soil and reduced surface runoff, thus checking erosion and loss of fertile topsoil and promoting better plant growth.

**Reseeding.**—To aid in reseeding depleted ranges, many species and strains of grasses and legumes from different parts of the world have been tested in nurseries in the western, southern, and southeastern regions. Tests of the preference of grazing animals for a number of species, conducted in the intermountain region, show that preference value changes during the growing season and that some little-known species have a higher preference value than crested wheatgrass, an introduced species which has been seeded successfully on a good many thousand acres of deteriorated range land. Although only a few were tested, legumes generally were higher than grasses in preference

value for cattle. Smooth brome, tall oatgrass, and intermediate wheatgrass all proved to be high both in yield and preference. Extensive plantings of these species will materially increase forage production on range lands.

By applying the reseeding knowledge developed through research, private stockmen have successfully reseeded more than 680,000 acres in Utah, Idaho, Nevada, and southwestern Wyoming. In addition, the Forest Service has reseeded more than 150,000 acres of national-forest range land in the intermountain region.

Many range types throughout the West and in the South and Southeast still remain to be studied. The "know-how" has not yet been developed for reseeding many sites and types that will not revegetate naturally even with good management within a reasonable length of time. Continued and expanded search is needed for new forage species and strains adapted to severe environments and resistant to erosion and grazing use. Methods of seeding slopes too steep for ordinary equipment are needed. The conversion of brushlands into productive range by removing the brush followed by reseeding and good management is a challenging problem throughout the West. In the South and Southeast the job ahead is to discover species, varieties, and strains of forage plants which will give maximum improvement in forage values and the greatest possible duration to the effective green-forage period and to develop economical methods of seeding them on cut-over forest range lands.

In addition to these widely recognized needs for additional research, many special yet highly important problems exist. Many national-forest ranges in the West have become infested with Wyethia, an aggressive perennial forb of low forage value. Conversion of infested areas to the production of range forage is a problem still to be met. Similarly, vast acreages now in tarweed, goatweed, or dandelion, but capable of producing good range forage, need to be converted. The methods and procedures for accomplishing this task are not yet known and can be developed only through research.

Cheatgrass brome, an aggressive annual grass, has invaded millions of acres of range land throughout the West. It provides some forage on spring sheep ranges, but later in the season it becomes a hazard due to high inflammability and the presence of awned seed. How to remove cheatgrass, as well as the even more fundamental questions of whether it should be replaced by perennial species, and, if so, will the increased forage values justify the expense are additional questions that remain to be answered.

## Forest Economics

**Forest survey.**—Considerable progress has been made toward completion of the Nation-wide forest survey. This inventory of the Nation's strategic timber resources, authorized by the McSweeney-McNary Act of 1928, is designed to obtain basic information on forest areas, timber volumes, ownership of forest land and timber, rates of timber growth, the drain on timber resources through cutting and destructive agencies, and prospective requirements for timber products. Such information is essential both for the formulation of sound forestry policies and for business decisions of forest industries and landowners.

Initial field inventory work was completed during the year in Arkansas, Missouri, and Illinois; and substantial progress was made in New Hampshire, Vermont, New York, West Virginia, Montana, and California. Resurveys also were made in a number of States where the initial surveys were made a decade or more ago or where there have been marked changes due to growth and cutting. These resurveyed areas included portions of Mississippi, Minnesota, Michigan, Washington, Oregon, Idaho, and South Carolina. In both initial work and resurveys, continued attempts are being made to improve statistical methodology and methods of aerial-photo interpretation. To meet the many needs of public agencies, forest industries, and others for complete and reliable data on forest resources, the Forest Survey should be completed as rapidly as possible.

**Policy advisory functions.**—Because of world-wide shortages and the strategic importance of timber products, increasing attention has been given to forestry problems in national and international policy formulation. At the request of legislative, executive, and international agencies, a number of advisory reports in this field were prepared on a variety of forest and timber industry problems. These included, for example, an analysis of prospective timber supplies and requirements of countries participating in the European recovery program, with particular emphasis upon the role of the United States in meeting Europe's timber needs. Statements on the domestic supply and requirements situation for lumber and other forest products also were prepared for the Krug Committee on Natural Resources and the Harriman Committee on Foreign Aid. As in previous years, the Forest Service supplied the Food and Agriculture Organization of the United Nations with current data on forest resources and output of timber products. Reports to the Munitions Board analyzed the adequacy of United States timber resources to meet probable requirements, and measures required to meet needs for timber in time of emergency.

**Other economic studies.**—Among the economic obstacles to forestry in the United States is a pattern of ownership involving several million owners of small holdings, nonresident ownership, and a general lack of understanding of the potentialities of forestry. To determine the relation of forest-management practices to size and kind of ownership, factors influencing the intensity of management, and promising means of achieving better forestry, studies of forest-land ownership are being made in selected areas of the South, Northeast, and west coast. Other studies of the economics of forest management also are under way in several regions to determine the possible production and income from timber and range-land use, and policies necessary for continued support of local labor and industry. The importance of improving marketing facilities as a means of aiding both producers and consumers of forest products also has been recognized in the establishment of investigations of markets and prices for farm forest products under the Research and Marketing Act. These and other economic investigations under way are designed to indicate the conditions necessary for profitable management of timber resources.

## Forest Products

Forest-products research is aimed at more complete and efficient utilization of the forest crop through new and improved mechanical

and chemical conversion processes, through better harvesting methods, through the removal of obstacles standing in the way of the utilization of neglected species and waste of various kinds, and through improvement in the serviceability of wood and wood-base materials. This work is centered at the Forest Products Laboratory, Madison, Wis. An account of some of the year's activities follows.

**Wood sugar.**—One of the most promising potential uses of large quantities of low-grade wood and wood wastes is as sugar for industrial chemicals and livestock feed. One ton of pure wood, free of moisture, yields approximately one-half ton of sugars. The yield is less for some species than for others and is also reduced when much bark is used. Nevertheless, sugar can be made out of practically any wood, with or without bark. There are two major fields of industrial use for wood sugar: the production of industrial chemicals, such as ethyl alcohol, butanol, glycerine, and 2,3 butylene glycol; and the production of molasses or yeast for the feeding of poultry and livestock. Much of the recent work has been concerned with molasses. So far more than 20 tons of wood molasses have been prepared in the Laboratory's wood hydrolysis pilot plant and shipped to various agricultural experiment stations for feeding tests. Tests are under way on dairy and beef cattle, lambs, calves, hogs, chickens, and turkeys. Although none of these tests has been concluded, no unfavorable results have been reported to date. Little has been done as yet on the production or feeding of yeast made from wood sugar.

**Hardwood sawlog grades.**—There has long been a need for specifications that will permit the segregation of sawlogs into quality classes according to their yields of the various grades of lumber. They would provide the timber owner the opportunity of realizing the full value of the logs he markets, the lumber manufacturer the option of buying quality classes of logs that best meet his requirements, and the forester with the means of making more accurate inventories and appraisals. Work begun some time ago on hardwoods was completed, and there is now available a set of hardwood sawlog grades for application on a national basis. Work has been started on the development of southern pine log grades.

**Rayon pulps from hardwoods.**—In its work on the development and improvement of chemical and mechanical processing treatments for pulps to improve their quality and render them suitable for new uses, the Laboratory demonstrated that viscose rayon pulps can be produced in good yield and of good quality from hardwoods by both the sulfate and semichemical processes with and without hydrolysis of the wood prior to cooking. It was also shown that the quality of groundwood pulps from a variety of hardwoods and softwoods could be improved by bleaching with sodium peroxide and calcium hypochlorite. Neutral sulfite semichemical pulping procedures also were developed for making pulps for creped insulating paper from hardwood and softwood mill waste.

**Paper surfacing for plywood.**—The use of resin-impregnated paper as a surface sheet for veneer or plywood gives great promise for improving the abrasion and scuff resistance of wood, improving paintability and resistance to face checking, and upgrading low-quality veneers. A study was made of the effect of the resin content of the overlay paper on abrasion resistance, water-vapor transmission rate, dimensional stability, strength, stiffness, and loss of strength upon

wetting. The results are proving useful to manufacturers in selecting the minimum resin content permissible to achieve desired properties in the surface sheet.

**Nailing.**—Although nailing is one of the oldest and most commonly used means of fastening wood members together, little attention has been given to a recommended practice or standard procedure for good nailing. To fill this important gap in technical literature on home building, the Laboratory, in cooperation with the Housing and Home Finance Agency, issued a publication on the "Technique of House Nailing." Based on data obtained from tests, observations of nailing practices, and information from architects, engineers, and carpenters, the publication gives nailing procedures to insure satisfactory strength and rigidity of the structural parts of a house. The booklet contains over 50 illustrations of good nailing practice so that it is of considerable value to the apprentice as well as to the more experienced carpenter.

Results of a study of equipment requirements and methods involved in fabricating simple lines of products at small mills were incorporated in the publication, Fabrication of Wood Products of Small Sawmills and Woodworking Plants.

Research and technical services were provided by the Laboratory to the Army, Navy, and Air Force to assist them in solving various problems connected with their use of wood and wood-base products.

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